MNT1 Birds of a Feather

Written by James Hyder , SCME Industry Liaison and Synergy Innovation Coach – 6/30/2011

Summary of the Birds of a Feather Activity held at the Micro Nano Tech Conference 1 – May 9-11, Albuquerque, NM. Hosted by the Southwest Center for Microsystems Education, this activity was run and designed by Deb Newberry (Nano Link) and Bob Ehrmann (NACK)

Industry Issues (Group 1):

1) Administration wants to be involved in industry relationships, but relationships are not continuous (due to a lack of responsibility/formal relationship). Faculty is oftentimes left out of this relationship; faculty feels limited in their ability to form relationships and suffer from a lack of coordination in Industry Advisory Board relationships that do exist. This begs the questions: who should be on advisory committees, and who on the committees should be helping faculty (subject matter experts? Management?). These really are situational depending on what the school needs.
2) How do you get materials from Industry?
3) Few local industries for partners begs the question, "How to attract industry to your local area?"
4) Working with proprietary material is an issue.
5) Getting industry to share information with institutions (government institutions and marketing departments to share information?
6) How do you get people to take advantage of SBIR proposals/opportunities in underserved areas?
7) How do you get industry to hire 2 year graduates over HS diploma graduates that are trained by industry? What do you tell students/how do you convince industry that technicians need more than skill based training (they need a specific degree)? In some instances, Industry is training HS and below (for certain tasks) and then hiring them based on performance. Industry does not seem attracted to 2 year graduates. This is the case in two primary instances: in cases where industry desires four year graduates over the two year and when they desire High School Diploma plus skill based training/certification over a two year graduate.
8) There is reluctance to rely on local industry because they could relocate/go out of business and the school would be left with a "shelved" program.

Industry Issues (Group 2):

1) Who should contact who; industry to educator or educator to industry?
2) What is the goal of the advisory board? When the CC is looking at the current economic outlook or business conditions/outlook.
3) How does a Community College build and sustain a relationship with Industry? What is the buy in strategy for industry? What does industry expect to get out of the relationship?

4) Do Community Colleges need to get industry to see the value of a two year technician? Do they own this responsibility? Some participants believed we need to look at needs 2-5 years out and perform a quarterly review with local industry to determine if what the advisory committee believed was the case is still the case!
5) How do you get industry to participate in advisory boards? Industry needs a need (they need to have a workforces problem that needs to be solved) so they can go to colleges to fill the need. They need to see a business relevant need and Community Colleges need to provide something to Industry how they can help. Business (Industry) wants to be viewed in a positive light; there needs to be a market pull (what is the marketing advantage for industry?) and Community Colleges need to demonstrate the ability to solve problems for Industry.

Based on the above, the following were the Industry Groups Top Issues:

1) How do you start (build)/sustain a continuous relationship with industry advisory boards? (7 votes out of 28)
    - Formal structure for organization – Have a champion (or multiple champions) within the College that manages the relationship. Another model, for ATE Centers, is to have an "Industry Liaison" that manages relationships between partner schools and local relevant-to-the-program industries.
    - Need portions of the membership that is consistent.
    - Need to define the role of Industry Advisory Board participants.
    - Draw and organization chart which emphasizes "regular" and "situation-dependent" contacts.
    - Ensure everyone on the board (Industry and Educators) are driven to (prioritize) collaboration!
    - Ensure that someone (Champion, Business Liaison or Industry Liaison) coordinates meetings, minutes, outreach and interfacing opportunities in such a way that IAB participants see the results of their efforts/participation.
    - To sustain IAB, have regular meetings at least twice per year and communicate with them regularly before meeting. (Munir S)
    - The college administration at its highest level must get involve, supported by the Dean, and the Department Chair. (NT I)
    - Invite the IAB by keeping them busy and involved giving tasks and listing to their needs (use "open house" and bring a lunch). (Jorge R)
    - Keep a log or whiteboard of all industry relationships and email them monthly, call to say hello, use social media to stay in touch. Maybe have industry people give a guest lecture to stay connected. (Robert C)
    - Work with local chapters of IEEE, ACS, ASME and other professional organizations to find people (usually enthusiastic) that can help you find the right people in companies and they may even help you directly. (Deb N)
    - It is so important to remain in consistent communication even if in a brief email. All industry volunteers should be acknowledged in the community publication and on the

district website. At the high school and middle school level, industry participants should also be shown in the yearbook and conspicuously in the front office. (Pam W)

- Spend time developing personal relationships through inviting industry to a planned tour of schools; provide "entry points" for business to get involved i.e.; be a critical friend for student presentations; have an industry steering committee w/ short, succinct meetings; have an entire model for this at your high school. (Laure L)
- Invite them to sit on "advisory board teams" at your school.
- Have clear objectives: What can we do for industry? What can industry do for us? Then market/ask for what you want and give what you say you'll give. (Jim H)
- Set up an ATE Liaison whose responsibility it is to establish regular meetings, make contacts, ensure focused and productive agendas. (Diane W)
- Communicate often – email, phone, lunches, site visits, stay in touch frequently. (Robert T)

2) Who should serve on an Industry Advisory Board? (4 votes)
    - A Technical Manager should be a permanent member on an Industry Advisory Board; a permanent member can bring content experts or business liaison when need to ensure more continuity/surgical precision to the problem being addressed.
    - Human Resource or Workforce Development is a good contact to make because they could direct you to additional resources.
    - If possible, include a graduate student to provide perspective. (Adrian)
    - Middle Level Officers – Design Engineer, Manufacturing Engineer, Project Managers, Maintenance Manager, Shop Floor Managers. (Edinbarough UTB/TSC)
    - People that will advise and guide you; not friends, associates, ect. (Rob T)
    - Managers, Engineers and Technicians
    - Those with a need they have to fill. (Luis)
    - Depends on the goals/mission of the IAB; multiple champions and a model that has fixed representatives who bring guests based on need. (Jim H)
    - WHOMEVER fills the role should be willing to actively participate.
    - Advisory boards should be designed for specific areas of interest; CEOs can support with big picture/marketing while technical experts can provide program and subject matter expertise.
    - Need a balanced board with people that can get things moving and people that have deeper knowledge about education/curricula. (Jorge R)
    - Depends on goal/mission of the board: 1) determine strategic direction of programs (CEO, Department of Labor, HR) and 2) help in curriculum development/skills required (technicians/engineers). (Diane W)
    - The people who are performing the skills you are teaching. (Paul)

3) How do you convince industry to hire two year graduates? (6 votes)
    - Career internship programs for students to prove their "worth".

- Find good students at the AS level who can do the work they need done. (Robert C)
- Have the advisory board discuss successful interns.
- Need to educate HR/Management on the value of the two year graduate (similar situation with Engineers and Engineering Technicians) and showcase programs. Develop co-op/internships for AAS that allows them to demonstrate skills. (Jorge R)
- All of the industries that have manufacturing do hire AS degreed technicians. Industries relying on R&D only and have overseas manufacturing only need hire educated students. Develop and encourage manufacturing in the United States. (Youner A)
- Create the list of skills, knowledge and abilities your teach – sell, sell, sell. Spend time explaining – give them some tests from the classes, show pictures, give them your BEST student for internships, ect. (Deb N)
- Provide documented skill sets for graduates to include in résumés. Develop student performance/project portfolios.
- Demonstrate capabilities of your students.
- Make sure your students can demonstrate some immediate value (perform well during an intern) and ensure they are ready to be trained (an attitude of a lifelong learner). (Jim H)
- Internships to get our students in the door at low risk to company.
- Advisory Board members should provide the answer to this question (they make the program content relevant). Partner with local chapters of professional societies for their input and direction (SME, ect.).

4) Whose responsibility is it to contact whom? Educator to Industry or Industry to Educators? (The group chose this as a fourth issue because a) it wasn't on the list to be voted on until after the voting started and b) it relates to the other three issues.)

- It's collaboration between industry and post-secondary educators. The difficult part is identifying the need in industry that schools need to fill. (Luis)
- Educators should take the lead.
- Lead faculty and/or PI is responsible, but the Dean can help out. (Robert C)
- Educator – Do your homework before you call the company to meet. Know product, market, etc. Don't go in with a blank page; have suggested skills or knowledge that <u>you</u> think <u>their</u> employees need. (Deb N)
- All parties involved. If industry and university (faculty/administration) has bought into the idea, each one must appoint people to the board. Otherwise it might be biased. (Jorge R)
- High School/Community College/4-Year: Directors of program, college presidents, alumni, faculty.
- Colleges and schools

- The industry relationship needs to be fostered by the education representative. Industry will not know the skill sets that can be provided at the associate level unless "you" find the key individuals and let them know. Then follow up, follow up, follow up!
- CC/ATE should establish and facilitate IAB. Industry responsibility to make time to be active in it. Goal/Mission of the IAB needs to be established. (Diana W)
- Advisory Boards should be active members with assignments to complete before the next meeting (limited to 2 meetings/year). Keeping members actively involved is key! (Rick H)
- Department Chair works with faculty in bringing and sustaining good IAB members. (Edinbarough UTB/TSC)
- The co-op office, the Dean, the Department Chair, the Program Advisory Board, the Community Relations Office. (NT I)
- Group effort – bring in as much support as possible. This should be a group effort with a leader who is likely Administration. (Rick B)
- Department Heads and program leaders are responsible to build IAB. (Munir S)

Thanks to Kristi Jean for providing the below notes:

Participants:

Group 1 – Mark (HS), Jana (HS), Cole (CC), Pam (HS+), Eric (HS), Luis (HS/CC), Lizette (CC/HS), Jim (Tech School), Wesley (CC), Rogerio (CC+)

Group 2 – Billie (CC), Holly (CC), Brad (CC), Robert (Univ), Adrian (HS), James (SIPI CC), Carrie (CC), Abraham

Rounds 1 and 2, with Round 2 ideas indicated by (Group 2)

1. Registering for classes, there is a lack of knowledge by parents, students, and counselors (it sounds hard) – 5 votes
2. 2-yr stigma by students, parents, & society – 4 votes
3. Lack of hands-on knowledge/experience at home – 4 votes (Group 2)
4. How to gain interest in a limited time (when you bring an expert to a class or doing outreach)
5. Lack of content
6. Testing demands have increased
7. Lack of CC programs by region – 1 vote
8. Curriculum demands

9. Recruitment (ties to money and their future) – 2 votes
10. Students need to have better access to information (Group 2)
11. Money or funding for programs
12. Lack of basics (math, ELA) – 1 vote
13. Students are lazy (Group 2)
14. Barriers such as language, 1st generation student
15. Increase in standardization, so no time
16. How do we get more girls & minorities involved – 2 votes
17. Issues outside of the classroom (i.e., attendance) – 1 vote
18. Encourage the average (Group 2)

Based on the above, the following were the XXX Groups Top Issues:

1) **Registering for classes, there is a lack of knowledge by parents, students, and counselors (it sounds hard)**

#1 All tied together:

- Have your current students visit perspective student classes to explain the program – Mark
- Present your classes (nano, etc.) in classes that all students take. We have done this in our math classes – no name
- Adopters of nano/micro technology must also be promoters of these technologies. Speak with counselors, at division meetings, at high schools, at outreach events (as many as your schedule allows) – Kathy

#2 Each student in my math/sci program receives a custom DVD complete with an entire library of photos celebrating our activities, field trips, guest speakers, etc. at the end of each semester. We also play parts of it at assemblies, throughout the year and during morning announcements. The word gets around. Each guest also receives a DVD – Pam W.

2) **2-yr stigma by students, parents, & society**

#1 All tied together:

- If funding is available, HS visiting the CC campus would be ideal.

- Take HS students to visit. Invite parents to come along – Adrian
- More collaboration between HS & CC
- Trade & Tech day for HS teachers & advisors – Marc Kalis
- Bring CC faculty & students to the HS, tech centers, etc. Explain articulation agreements for college credits. Discuss current technology jobs. – Paul

#2 Tied together:

Counselors need to be informed with a wealth of information (job placement, programs, academic prep, etc.) about 2 yr schools. They need to be brave as well, because many ill-informed people see 2-yr schools as a negative or a "catch all". By getting 2-yr schools to complete outreach programs in HS's, many kids will be interested & informed – Tim A

Offer a 4-day summer counselor career awareness seminar – Kristi

3) Lack of hands-on knowledge/experience at home

#1 Remedial math is needed so maybe remedial "shop" class will be needed as we move away from a rural community. – Rick H.

Additional comment – Include or review the new technology/engineering class content. The grade level is important from the optional class standpoint, meaning that older students might not sign up for the class. Can it be done at a lower grade level?

Deb

Verbatim transcript of Tuesday afternoon forum - sheets

Here's the raw data from our session:

Administrative support

Champions for innovation, even small ones

Consistency

From ideals to execution; how?

External no-cost solutions can help

Faculty resistance to nanotech and emerging techs

Top-down doesn’t work

“I will help you teach what you don’t like to teach”

Undefined outcomes

Transfer/HS standards

Recognized standards across the nation for nano courses

Industry disinterest in AAS techs

How to leave your (our their) comfort level?

Motivating tenured faculty to make changes

Need for professional development in nano teaching – best motivators?

Awareness of professional development opportunities

Need to find mentors

High school/community college advisor awareness

Student awareness

Need for full packages of curriculum

How to train for a two year career- or should we?

Tom

Thomas L. Deits, Ph.D.

Chairperson, Science Department

Lansing Community College

PO Box 40010

Lansing MI 48901

Phone 517 483 1085

Fax 517 483 1003

ICQT's Regarding Students

Thanks to Sebastien Maeder for the notes on the below section.

Part 1- Top Two : Prioritized List of ICQT's and Possible Solutions From Two Interested Groups of Participants

- **Increase Student Interest and Engagement**
  - Start early, even K-5. (Paul)
  - Full immersion; upper and lower levels, M/F, etc. (Paul)
  - Relevance; problem based learning, context, narrative. (Dave and Rick)
  - Chunking and formative assessment. (Dave and Paul)

- **Foundations of Math and Science**
  - Rigorous progression and review (?)

Part 2- Suggested Solutions From All Participants

NOTE: After collection, evaluation, and discourse on all suggestions, they were immediately categorized into two groups. The first group (+) are those that were determined to be the most effective and achievable, and the second group (-) were determined to be less effective or already represented by some solution in the first group.

Increasing Student Interest and Engagement

(+)

- Use real, relevant, project based learning. Students will be engaged when they see the relevance and know they are impacting. (Diana Weldon)

- Jobs and money can get and keep their attention (Jim S.)

- Find great, inspirational teachers… or give industry personnel the opportunity to present an extraordinary experience for students. (Hilary Rully)

- Two year CC students should be mentors to HS students, just as HS students should mentor MS students, and so on. (H. Riely)

- Stair step engagement and responsibility. HS students invest where they feel healthy responsibility and the possibility of meeting achievable results. Teacher should prepare HS students to pass on (teach) a hands-on technical concept to a K-8 "buddy". (Adam Brechtel)

- Start early (kindergarten) to hook them to science. The tobacco industry has proven that it works! Provide a hands-on science center for K-6 schools. (Younes Afaiiyan)

- Introduce students early to exciting applications using nanotechnology through a seminar course. Develop a student learning community (Nano club) to keep them engaged; particularly use extracurricular activities such as industry tours, picnics, and outreach to other schools. (Anura Goonewardene)

Increasing Student Interest and Engagement Continued…

(-)

- Encourage participation in summer science and engineering programs. (Wesley Sanders)

- Get teens excited! Get into MS and HS classrooms and excite them with the current Nano applications and future solutions to medical, energy, and environmental issues for which nanotechnology provides a solution (Bob Ehrmann)

- Hands-on experiments. Be excited first, and engaging. Survey what other people do. (Ahmad Audi)

- Make the class awesome and word will get out. (?)

- Teach science, math, and technology early and continue from K-12 so students are prepared to enter 2 and 4-year programs. Include all students. Reduce or eliminate remediation. (Paul)

- Show them the applications. Use NACK's product box as real-world examples; socks, Rain-X, plunger. (Deb Newberry)

- Exposure to careers and positive role models to serve as mentors. (Shyr?)

- Exposure (E.S.)

- Have students do small research projects that are interesting to faculty. (Robert Cormia)

- By encouraging school counselors to attend events such as THIS one. Bring home fresh ideas to students and families. (Tim A.)

- Guest speakers, clubs, 1 week summer programs working with local CC's and Universities. Real life applications infusion is a must! (?)

Enhancing Foundations in Math and Science

(+)

- Make math and science relevant. Teach them in context. (?)

- Use project based problem solving. Motivate. Ask students for previous knowledge. Use intellectual engagement of different kinds. Make sure students know how to collect and use evidence. Each day, make sure that students can make sense of what was taught. (Paul)

- Educational reform should also allow for STEM credit. Use an integrated discipline approach. For far too long we have ignored the true purpose of education, to connect what students know to real-life situations. When subject areas become interconnected, students connect learning in math to science, and science to problem solving, and problem solving to the real world. THAT can be powerful! (Hilary Rully)

- Nano science could be the answer as it is a convergence of science and math. Have a Nano class for students with different experiences. (Ahmad Audi)

(-)

- We will never get away from pretesting and remedial math needs. Some students just need 3 years to finish a 2-year program. I don't see this as a "real" problem. Just get them up to speed and get them out to the workforce. (Rick Henderson)

- Hire high school science and math teachers with appropriate backgrounds. Example… Chemistry teachers should have a BS in Chemistry, not Biology, Earth Science, General Science, etc. (Wesley Sanders)

- Hire dynamic, well-educated teachers. Real life applications to as many problems/concept as possible. (?)

- Inspire Math and Science K-6 teachers! In general, many teachers are literature philiacs while math and science are simply footnotes. I spoke with a teacher who took a math workshop and said it was "like a spiritual experience"! (Adam Brechtel)

- Communicate challenges to parents, elementary school and high school educators. Utilize distance technology and the web to bring expert instructors in at all levels of education. (Sheryl)

- Work with younger students; Pre-K-6 education. (?)

- Articulation with colleges to give college credit for high-level HS math and science courses. (?)

- Community Colleges can use supplemental instruction in math and English (as extra credit possibly) to help shore up their foundational skills. (Kathy Flynn)

- Sponsor and support science Olympiads, robot contests, skills contests, etc. (T Dect.)

Part 3- Concise, Clarified Solutions to Top Two ICQT's

- **Increasing Student Interest and Engagement**

    - Embed real-world conditions, experiences, and opportunities, including career opportunities, into all (K-16) science and technology pedagogy and assignments.

- Embed innovate innovative opportunities for industry and community involvement as well as real social experiences, such as field trips, 1 week camps, clubs, etc. providing food and knowledge to feed the body and mind.

- Provide adequate scaffolding and use peer mentoring and internships to provide true depth and immersion as a way of using what is learned in the class, out in the real world.

- **Enhancing Foundations of Math and Science**

  - Math and Science, as well as the other parts of the STEM directive, need to be taught in context, without boundaries between the disciplines, using project-based learning (PBL).

  - Implement peer-to-peer mentoring and advising in order to give students the necessary help, support, and guidance when they need it most.

  - Begin early. Whether it is introducing PBL in the earliest educational years, or spotting weakness in certain skills early on, early immersion and intervention will help with building a core of math and science skills and retaining them for the future.

Student ISQT

Session 1 Participants: Mark HS, Jana HS, Cole CC, Pam HS+, Eric HS, Luis CC/HS, Lizette CC/HS, Jim Tech School, Wesley CC, Rogerio CC+

Session 1 Comments:

- Teachers need to get involved in a child's future. Needs to ask the big questions what do you want to do? and Where do you want to go?
- More entrepreneurial emphasis in high schools and community colleges.
- Ethical analysis taught.
- High School flow of content in writing (algorithms).
- Clear education to economic pathways shown.
- Work with your state department of education to help write the standardized exit exams. AZ uses teachers to write high school exit exam.
- Get educators on test writing panels.

- More exposure to nanoscience starting at an early age.

Session 2 Participants: Bill CC, Holly CC, Brad CC, Robert 4yr, Adrian HS, James CC, Carrie CC, Abraham

Soft Skill Curriculum

- Use an introductory nanoscience seminar setting to give student presentation skills. They also can be introduced to library literature searches etc. Use a student learning community such as a nano Club to get students to interact socially. Give them responsibility for organizing outreach programs that will help them mature. (Anure G)
- Integrate 21st century learning outcomes/soft skills across curriculum and projects, support explicit development of skills and assess. See Tech Valley HS rubrics. (Laura L)
- Community College "knows" what soft skills are needed, so provide short seminars on soft skills. Use on-line resources for technical students ("Tooling U" has modules).
- Let's rephrase: "soft" skills (with a negative connotation) to 21st century skills (our current jargon) and align with the Partnership for 21st Century Skills.
- Tell the students up front that good attendance is the key. We can help them if they are there. We seem to attract lots of dreamers who need to buckle down and learn to be responsible. (Kurt C)
- Provide "safe" (fake) networking opportunities for students to practice soft skills (mock interviews, on campus poster presentations and invite industry or grad students). Provide feedback in an organized manner. (Alissa A)
- Enlist on-campus career services to provide resources and give resources to your students. (Alissa A)
- Use teams in classes and projects. Scaffold and assess separately for soft 21st century skills. At Tech Valley we separately assess collaboration and self-direction (+ 5 others). (Diana W)
- Employers need to be more vocal about what they want – soft and hard skills, knowledge, training. (Jim S)
- Incorporate soft skills into curriculum. Make attendance mandatory. Have a professional dress day. Have group based projects and presentations. (Luis)
- Include presentations as part of most assignments.
- Work with Community College to develop appropriate High School curriculum.

Registering for classes, there is a lack of knowledge by students, parents, counselors, (also ties to "it sounds hard").

- Each student in my math/science program receives a custom DVD complete with an entire library of photos celebrating our activities, field trips, guest speakers, etc. at the end of each semester. We also play pars of it at assemblies, throughout the year, and during morning announcements. The work gets around. Each gest also receives a DVD. (Pam W)

- Adopters of nano/micro technology must also be promoters of this technologies speak with counselors, at division meetings, to high school, at outreach events…as many as your schedule allows. (Kathy F)
- Present your classes (nano, etc.) in classes that all students take; we have done this in our math classes.
- Have your current students visit perspective students classes to explain the program. (Mark P)
- Let's change the focus from "it is hard/difficult" to "are you up for the challenge?" (TD R)
- Informal meet/coffee break/brown bag.
- Bring elementary students to the high schools, middle schools, CTE schools. Let them tour and participate in the classes. (Paul)
- Curriculum/Course grid for degrees and certificate program must be easily available and accessible to students, parents, counselors. Advisors and Counselors must be trained! (NT I)
- Infuse nano through real life application (products) when students are young.
- Build more vocabulary and more products through middle school.
- Build more in depth concepts and hands on activities at high school level.
- Utilize a new mobile phone connection approach called Job Rooster to continuously connect with and advise students. Cost is about $10/student per year. www.jobrooster.com (Mike L)
- Make sure you have strong industry partners for internships and placement rates. (Kurt C)
- Info sessions and actual "sign-up sessions" to show them how easy the process can be. (Jim S)
- In college, assign advising staff to teach one class (or in high school too). (Holly M)
- Information sessions for students, family and counselors, visiting area high schools, participating in public events with some magic shows. (Ahmad A)
- Teacher meets with each high school student. Visit colleges. (Adrian)

Lack of hands on knowledge/experience at home.

- Give homework to bring in labels/products that have a link to nano.
- Need to invite them to be active part of process, not first lecture an open house. (Perform some of the activities of the ATE. (Jorge R)
- Make your kids mow the lawn, rake leaves, landscape, trim bushes, ect.
- Remedial math is needed so maybe remedial "shop" class will be needed as we move away from a rural community. (Rick H) Include or review the new technology/engineering classes; grade level is important from the optional class standpoint.
- Schedule parent nights with science, math and technology. Parents love it! (Paul)
- Bring back students who have been through the program to talk to parents and students. (Jana)
- Open science days could be a good starter. (Ahmad A)

2 year stigma (includes parents and culture)

- Use media and industry testimonials including AAS employees telling how rewarding (success and $) their jobs are. (Diana W)

- Establish and publicize (big time) agreements with 4 year colleges (actually high school + 2 + 2). (Jorge R)
- Change their attitudes during orientation. Many come to 2 year colleges just to get by easy (or they think its easy) and have a certificate or a 2 year degree. (Farzan N)
- Push the data that shows our students do well after transfer. (Tom D)
- Have 2 year students develop and lead projects/labs with students.
- Summer counselor career awareness seminar (4 days). (Kristi)
- Counselors need to be informed with a wealth of information (job placements, programs, academic prep, etc.) about 2 year schools. They need to be brave as well, because many ill-informed people see 2 year schools as a negative, or a "catch all". By getting 2 year schools to complete outreach programs in high schools, many kids will be interested and informed. (Tim A)
- Trade and Tech day for high school teachers and advisors. (Marc K)
- Bring Community College faculty and students to the high schools and tech centers etc. Explain articulation agreements for college credits. Discuss current technology jobs. (Paul)
- Take high school students to visit. Invite parents to come along. (Adrian)
- More collaboration between high school and 2 year. (ES)
- Funding high school to visit community college would be ideal.
- Get industry involved in visiting schools, parent and student info sessions, etc. promoting their company and their need for trained workers. (Jim S)
- 2 year stigma can be removed by advancing quality education and advocating the low cost of 2 year institutions. Besides transitioning sometime could be difficult for students from high school to university; thus 2 year is a good medium. It is a good affordable, close option for high school students who would like to put themselves in college level studies. It is an alternative option to get a good education when quality teachers at high school are not available. (Ahmad A)

Administration (High School, Community College, University) ISQT

1. Funding for programs (6 votes)
2. Administration buy-in-performance measures (3 votes)
3. Getting them to understand the program (2 votes)
4. What's in it for them? Why? Value of the program (2 votes)
5. What is the impact of the program? (3 votes)
6. Who are key decision makers? Institutional structure (4 votes)
7. Cross-disciplinary nature of nano education (with multiple departments) (5 votes)
8. Justify emerging tech program with low enrollment? Not a clear need for large numbers of techs (finding data). What is job placement? (4 votes)
9. Faculty and department buy in (5 votes)
10. Constant changes in administration – sustainability (3 votes)
11. Alignment with high school pipeline to college (3 votes)
12. What resources are needed?

Group 1: Izuchi, Eydgahi, Sebborn, Berenstein, Hale, Reyman, Suliman, Najmahadi

Group 2: Rodriguez, Whiffen, Tsui, Brechtel, Ataayan, Reilly, Nantundaswamu, Hendrickson, Decker

How to get cross disciplinary faculty and department buy in?

- Share information from the Department of Labor and industry on trends and future needs for employees. Have faculty and administration attend conference/panels with Department of Labor and industry answering those questions. (Diana W)
- To engage college level administration, have industry advisory board invite them for lunch (no presentation). (Mike L)
- Need a champion (leader and ideally support from a Dean or Department Chair. Develop projects, workshops, units, that are cross-disciplinary that students can do. The time for "explaining is over!" Invite administration to observe. (Laura L)
- Give them release time.
- Bring in students who are currently in these programs as well as graduates who have been hired in the field to discuss their success and excitement.
- Hands on demos (nano days) kit type for department.
- Try to increase and excite interest about nano tech in the department. If we don't jump in the boat leaves without us. Write a 2 page proposal to the Dean. (Farzanch N)
- Offer them updated tools and equipment (bribe).
- One way to get buy in is to make sure you get publicity for your program. The local media and success educational stories; especially if you neatly write the article yourself and include engaging pictures. In your article be careful to acknowledge the support of your district and brag about the district. Publicity is key! (Pam W)
- One "successful" nano university faculty member said, "you need to find one champion or visionary at the administration leadership level (1-2 steps above faculty)". He (she) has to "ask the right questions" and support "faculty" to develop new program (or course). Don't try to force it, but keep urging faculty to look for the "best way" to start a new nano program. Be realistic, it will take longer than you think, but be persistent.

How to explain the cross-disciplinary nature of nano education (multiple departments)?

- There is currently a computer based program called "Atlas" that allows specifically for this cross disciplinary learning. Input standards, goals, etc. across departments and you use it as a search engine within your institution. (Tim A)
- Look for faculty who have multiple disciplines and cross list approved disciplines to be multidisciplinary.
- Take standards from multiple content areas. Write/Implement a unit encompassing standards from the different disciplines and offer to each department. You may initially have only that department's standards on it. (Diana W)
- Create a multiple disciplinary team with a member from each department involved.

- Encourage faculty to visit local science centers that have nano exhibits. Organize seminars/brown bags (all staff learning events). (Rashmi)
- Consider developing a "nano impact" publication similar to the Nano Center impact booklet. Showcase the projects/centers and include contact persons or websites that can briefly explain what they do.
- Give examples from local companies; make it visual such as with posters, brochures, etc.
- There are many "real-world"" industry examples where "multi-disciplined" nature of nanotechnology solves real problems. For example, from Dave Arney of 3M, IBM (Researcher) teamed with Singapore Biotechnology Institute to "demonstrate" "nano" solution to destroy MRSA virus cell (without creating drug resistant virus). Create posters for students, access we materials. Can nano centers help to analyze, organize and publicize.
- At community colleges we have four programs under manufacturing technology. I propose taking one program (Mfg engineering technology) and modify it to include a materials science option (one that includes nano courses). This approach avoids a full program review and getting major new program approval. (Tom R)
- Career Pathways that lead from secondary to Community College to University. Our CTE schools (high school) run middle school tech competitions for students to explore potential career pathways into high tech industries. Once students enter the high school program they can earn articulated credit at the community college in the high tech program. When students graduate high school they enter the community college high tech program with advanced standing. Out CTE central admin meets with district superintendents and community college central admin to align goals. (Hillary R)
- Promote faculty externships (Sheryl)

How to get funding for programs?

- One successful nano program said "start small", adopt/adapt existing materials. Start with a "nano I survey" course to attract students from multiple disciplines. Another 2 year college (no labs) worked with a local state university "talked to the physics department and was able to hold all labs for 2 year students at university ("nano Fac. Coordinator" did it on her on). University recruits students in 3-years2-years College and offers a 1 year certificate /2 year Associates degree + transfer option.
- Assess industry needs, find a high tech, science driven area of focus and inspire the community with your forward thinking. (Kurt C)
- Consortiums work well, industry/university/government form agreement that has benefits for all 3 (e.g. addresses industry needs, develop workforce, have graduates). (Jorge R)
- Work for politicians who understand why we need to pay taxes for good government and good schools. (Tom D.)
- Be sure to secure and provide the data that supports the need for this program. Suggest sources of funds if you know one. Be ready to offer your time if needed.
- Grants (NSF and Local Colleges).

- Co-author a grant with education as the "lead" and offer industry the opportunity to be a part of the funding.
- Learn how to write and run successful grants. You might need to collect a number of small "pocket change" grants until you get "visible" momentum. (RD C)

Faculty

Who are we serving in our curriculum? Industry? Transfer students? How do we decide and deliver the right skills/learning objectives?

- Students
- A program should train students/incumbent workforce. Transfer students also serve to gain experience for the workforce. Industry drives enrollment for most needed programs. (Rick H)
- Bring industry into the curriculum writing process. Bring faculty in from industry that have experience and skills in the areas you want taught. (Paul)
- Pick your niche. Don't serve them all. (ES)
- It depends. Some curriculums serve all of the above: industry, transfer students (for transfer students the curriculum must be designed to be in line with that of the 4 year college. For the industry, specific needs must be identified and curriculum tailored to these needs. (NT I)
- Consider "transfer rich" curricula – work with other tech careers to implement across programs. (Ahmad)
- All of them…define flexible curricula with core courses and option for electives that will serve specific needs. Perhaps diploma/certification instead/addition to 2 year degree. (Jorge R)

How do we increase awareness/interest among advisors, counselors and students?

- Make the class awesome and word will get out.
- Information sessions: sometimes specialized ones for faculty and staff, and some open to public, go to see some classes and give visiting lecturer. (Ahmad)
- Have advisors, counselors, and students visit industry or work in industry internships (school to work programs). (Paul)
- Invite industry to give updates about new research/products. Field trips for faculty, guidance counselors, to see workplace environment and products. (Laura L)
- Brown bag seminars and talks by industry people. (Rashmi)
- Booth at all school in-reach events, open houses and enrollment fairs etc.
- By way of outreach programs and opportunities, bring specific labs to students (remote access) and invite students into your college classrooms. (Tim A)
- One week programs in summer where they are announced in various ways to parents. Register through guidance counseling department. Run by directors, faculty and counselors. Offer scientific activities that engage all of them. These have to be activities that grab their attention. One example is a moon buggy race.
- Provide a short video (DVD) on the way nanotechnology is used in everyday use and in common products. (Brad J)

- Large scale advertising campaign. Saturate every school in your area with posters, brochures, ect. (Rick B)

How do we develop administrative/faculty champions for programs?

- Offer them new tools and equipment using grants, ect. (bribes).
- Identify candidates and provide incentives (release time, money, student help, etc.) for them to do the work of in establishing new degree/minor/courses. Recognize their work. (Jorge R)
- Encourage sabbatical (or unpaid) leave and internship in industry for faculty (externship) to bring them up to date and spark interest. (Younes A)
- Share information, vision and successes with your administrators. The more they know the greater the collaboration with faculty and ability to champion the micro/nano cause. (Kathy F)
- Faculty cooperation among programs are very important. (Munir S)
- Arrange for a short talk/presentation to stimulate more interest in faculty to gain support for a program in nano. (Farzaneh N)
- Conferences; presentations at faculty, department and board of education meetings; bring students (alumni) back to discuss successes.
- The program coordinator or department chair must be in the lead and must play the politics right. (NT I)
- Half day ATE Center showcase at AACC national meetings. (Tom D)
- Administrators rise to the top by stepping forward and doing what others will not do or do not want to do. (Paul)
- Offer to give guest lectures to classes in other fields, connecting to nanotech. Once you get student interest, it's easier to sell nanotech to faculty/administration. (Allis A)
- For faculty, educate administrators and survey for a good fit. For administrator, hire qualified and excited/exciting faculty. (Ahmod)

Facilities

Knowing:

- How to start a lab from nothing.
- The intended goal of the lab skills and abilities taught.
- A viable plan as the lab grows.

Acquiring:

- Funding/Grants
- Donations – How to manage.
- Staff and expertise.
- Infrastructure and ongoing operational costs.

Complying:

- With EHS.
- Access issues and users.
- Policy and legal issues.
- Involve your facilities and legal stuff from the beginning of the project and have them represented on the design team for the new facility. (Brad J)
- It would be helpful to identify and share experience contacts and share. (Rick B) This is relevant to knowing, acquiring and complying. Maybe a website dedicated to the issues.
- Know your local, state, and federal laws for safety; involve/inform EH & S on campus; regarding policies follow what others have done and modify to fit your needs; join list serve/lab managers at MIT. (Rob T)
- We've run our cleanroom for years without any lawsuits or hassles. Everyone has been healthy and safe. Safety tip: Use TEOS instead of silane for silicon oxides. (Kurt C)
- Administration is a key in this. Look at other departments with similar procedures such as chemistry/biology. Hire qualified people or consultation firms. (Ahmad A)