

STEM Visioning Forum

Meeting Notes

September 21, 2011

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Introductions, overview of career education in Nebraska, and clarification of deliverables

Membership divided into groups to identify the future of the Engineering, Energy and Research & Development career paths and the future of education related. These are the results.

Group 1

Future

- Ethanol – bio-fuels
- Research & Design on crop production
- Nuclear energy
- Wind powered
- EPA regulations
- Conservation
- Solar power
- Electric transportation and Distribution
- Hydroponics
- Geo – Thermal
- Hydronics – the transfer of heat from water

Education

- Wind for schools
- Alternative energies
- Introduction to engineering
- Skills USA/FFA
- Engineering
- Transportation
- Chemistry and biology and science and physics
- Future probe
- Rapid prototyping experiences – 3D printing “most cost effective investment at my company when they purchased a 3D printer”
- Nuclear power plant training
- OPPD Power Drive: Fabrication, problem solving and R & D
- Technical skills
- Power plant: intro
- Robotics
- Student Mentoring Program (Society of Military Engineers) – Mentoring – Problem Solving
- All students should have a long term mentoring opportunity which culminates in a competitive event.

Group 2

College Education - Full engineer (4 year)

- Manufacturing, Electric and Civil
- Energy – System Integration
- Mechatronics
- Wind Energy: Design, integrate, build
- Green Initiatives: reduced Energy use, environmental impact

Directly to Careers

- Manufacturing
- Skilled Labor
- Mechatronics
- Technicians

What's Offered Where?

High School	Community College	University
Introduction	Technical	Theory
Hands On	Hands on Mechanized Systems	
Technology- Computers Math – applied Show a connection between learned and how that applied in career/field	Academic Transfer to University Programs	

“The more exposure to industry we can provide high school and college students, the better because it’s a very stressful transition from school to career”. -- *Participant*

Group 3

- 2 Pieces: Uses
- How is it generated?
 - Fossil, nuclear, hydro
 - Sustainable: Bio, solar, wind
- Grid Management
- Distribution
- Research and Design/Development on all the above
- Environmental factors
- Focus on Battelle Study
- Should R & D be a pathway?
 - Permeates everything
 - Process vs. product
 - What is an example of career
- Engineers:
 - Process toward solution
 - Creative element
 - Marketing of careers

Three Key Questions:

1. Energy – Should the state adopt the ESU 4 Career Academy Model?
2. Engineering – What is an alternative Program of Study to the Project Lead the Way, pre-engineering curriculum? Is it reasonable to implement in smaller school districts?
3. Research and Development/Design – Should it be a separate pathway developed by the group or should it be embedded in other Programs of Study?

More information was shared about the ESU 4 and Metro Community College Energy Career Academy Programs and the curriculum involved in the Project Lead the Way, pre-engineering program available in some schools across the state. This additional information provided the foundation for the recommendations to the three preceding questions.

Question 1. ESU 4 has developed an Energy Career Academy in partnership with Southeast Community College, Nebraska Public Power District and Omaha Public Power District. Holly Carr, Coordinator, shared the sequence of courses and a general overview of the standards/units developed. For more information please go to <http://esu4energyacademy.wikispaces.com/>

Overview of ESU 4 Energy Career Academy Program of Study

- Course 1:** Energy Exploration Course (Junior and Senior Level)
- Unit 1: Energy basics and fundamentals
 - Unit 2: Energy Production
 - Unit 3: Energy Delivery
 - Unit 4: Energy responsibilities and decisions

Course 2: Advanced Algebra/Algebra II

Course 3: ENER 1100 – Introduction to Energy Generation and Distribution (Southeast Community College Course)

Overview of Metropolitan Community College: Residential Energy Career Academy Program

http://www.mccneb.edu/secondary/student/documents/2011-2012CareerAcademyProgramsClassSchedule_Descriptions_013.pdf

- INCT 1301 Home and Building Maintenance Carpentry
- ELTR 1200 Basic Electricity
- SNRG 1120 Weatherization Installer I
- SNRG 1121 Weatherization Installer II

Question 2. Overview of Project Lead the Way (PLTW) Model:

http://www.pltw.org/sites/default/files/GettingStarted_2011_0.pdf

Sophomore Class:

1. Introduction to Engineering Design
2. Principles of Engineering

Junior Class:

1. Computer Integrated Manufacturing
2. Digital Electronics
3. Engineering Design and Development
4. Biotechnical Engineering (optional specialization)
5. Aviation/Aeronautics Program (optional specialization)

Senior Class:

1. Engineering Design and Development
2. SAME Mentoring Program

Note: it is cost prohibitive for many small schools to devote the staff time, training and equipment to support a PLTW program. The Nebraska Department of Education and the Partnerships for Innovation recognize that PLTW is an exemplary program and desires to continue to support the efforts of local schools with the PLTW curriculum. However, NDE and PFI seek an alternative which can be implemented in more schools across Nebraska exposing more students to engineering, critical thinking and problem solving skills.

Additional Resources: [STEM 101.org](http://STEM101.org) is an online curriculum similar to PLTW

Report Out

Groups gathered to ruminate on the three guiding questions and reported their suggestions and findings. These are the reports from each group.

Research and Design/Development (R & D) Group Report

It is not a separate pathway; rather it is a process to be included in all the Programs of Study. It is an instructional strategy. R & D is a cyclical process demonstrated in Problem and Project Based Learning (PBL).

Consider Energy/Environmental as a pathway, not just an Energy pathway; this may attract more students to the field.

Identify the skill set of those who are successful in R & D. It is better to embed R & D than to try to create a separate pathway; for example, pick a week to give them a problem to solve; the learning experience is the R & D process. Try to teach the scientific method in the courses. R & D thinking is more gray while Math and Science is more black and white. There is a structure around R & D that guides the creativity process. Foster the spirit of discovery and entrepreneurship in all subject matter and courses.

Engineering Program of Study Report Out

- First thing asked: What can we borrow from PLTW without violating any copyright laws?
- All courses need to be designed around Project Based Learning
- Applied Math and Science need to be embedded in the courses

Suggested Course Sequence and topics to cover:

Course 1	Course 2	Course 3
Intro to Engineering	Yet to be named: Middle Level	Yet to be named: Capstone
<ul style="list-style-type: none"> • Career Introduction • Problem Solving Activities • Design of things • Presentation skills 	Applied Physics Activities that would relate to: <ul style="list-style-type: none"> • Mechanical Engineering • Electrical Engineering • Civil Engineering • Agriculture • Energy Engineering • ??? others 	<ul style="list-style-type: none"> • Good if it's Dual Credit but not requirement • Emphasizes Teamwork • Students working on projects in teams • Mentor Process • R & D Jury-Based Projects professionals in the field, B/I • Competitions

Energy Program of Study - Consider co-branding with Environmental terms

Course 1	Course 2	Course 3
<ul style="list-style-type: none"> • Energy Exploration 	<ul style="list-style-type: none"> • Applied Physics • Principles of Engineering • Principles of Technology • Auto, Transportation, Manufacturing 	<ul style="list-style-type: none"> • Advanced Energy • Intro to Energy Operations (SCC) • Station Engineering (MCC) • Basic Electricity and Processing Control • Bio-fuels • HVAC
Intermediate Algebra/Algebra II – co requirement		

Key Concepts to be covered in an Advanced Technology Course?

- Economic Viability of Energy, cost by type, cost per unit
- Projects

- Trade-offs – Morality/Responsibility Check
- Conservation vs. Efficacy
- Benefits vs. Detriments (Pros/Cons)
- “What’s next” Challenge – what is the future of the field
- Security
- Demand vs Consumption
- Think Global

Professional Development Opportunities Suggested for High School Teachers?

- Problem Based Learning
- Professional organizations
- Project Shine
- Listserv
- Teacher goes out into Industry
- Topic Workshops
 - Community Colleges/Educational Service Units
 - NCE Conference
 - Partnerships for Innovation Opportunities
- Peru Energy Institute
- UNO STEM Teaching Endorsement
- PLC – Professional Learning Community) – systemic, ongoing
- Learning Cohort
- PLTW-Summer Training Institute
- NASA Grant

Experiences for Students?

- Job shadow
- Mentoring – partner with industry
- Community service/learning
- Guest speakers
- Field trips/tours
- Paid internships
 - Summer
 - After School or last 1 – 2 Periods
- Documentation (Journal, record what they learned)
- Engineering Week – E-Week at UNL/UNO
- Professional Organizations (Nebraska Society of Professional Engineers, American Society of Mechanical Engineers).

Recruitment Strategies to Engage more Students?

- Better face on manufacturing and related businesses for students, mom and dads and educators
- Mentoring
- Job shadowing
- Interns
- Industry involvement
- Afterschool programs (Jeff Cole, Karen, 21st Century)
- 16 – 26
- Low Income
- Truck driving
- Explore scouts
- Live long learn