



Preparing a Workforce Through Curriculum Integration

National Science Teachers Association
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Why Teachers in Industry?

- Why do I need to learn physics? Or chemistry? Or mathematics? Or ...?
- Where am I ever going to use this?
- “How can teachers teach something they have never experienced?” - the late Melia Peavey, former president of Peavey Electronics
- What skills are required by industry?
- What careers require STEM?



Why Teachers in Industry?

- What basic skills and competencies are required by business and industry?
 - Communication
 - Problem solving
 - Mathematics and computer skills
 - Ability to work as a team
 - Strong work ethic
 - Accepting responsibility

Why Teachers in Industry?



"As teachers we learn a lot about theory but not application. Here, we learn why we teach what we teach."

Teacher, Mississippi



Why Teachers in Industry?



"Learning the physics behind the dry dock will be an excellent science application."

Teacher, Mississippi



Goals of Industry Experiences



- **Experience the workplace**
- **Learn real world applications of science, mathematics and technology**
- **Learn workplace skills and values**
- **Learn career opportunities – science, mathematics and technology requirements**
- **Establish relationships with local industries**
- **Integrate experiences into existing curricula**

Industry Partners



- **Northrop Grumman Ships Systems**
- **Tennessee Valley Authority**
- **Nissan**
- **North American Coal – Mississippi Lignite Red Hills Mine**
- **Columbus Air Force Base**
- **American Eurocopter**
- **Aurora Flight Sciences**
- **Rush Medical Center**
- **Meridian Air Base**
- **NASA Stennis Space Center**

Northrop Grumman Ship Systems



Northrop Grumman Ship Systems



North American Coal – Red Hills Mine



North American Coal – Red Hills Mine



Tennessee Valley Authority





Nissan





INDUSTRY EDUCATION PARTNERSHIPS



Goals

- Connect education with business/industry
- Develop a learning community that spans the education continuum
- Research the factors that contribute to the success of industry-education partnerships

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INDUSTRY EDUCATION PARTNERSHIPS

Components

- Teams of teachers grades 5-12, guidance counselors, administrators, preservice teachers
- Summer Workshops of variable length – multiple summers
- One week internship in local industry
- Academic year follow-up



Integration into the Curriculum



- **Increase relevance of subject matter by using real world applications of content**
- **Learn how changes in the workplace affect the role of educators in preparing students for the workforce**
- **Gain knowledge of today's workplace skills and workplace values**
- **Gain knowledge of career requirements and opportunity**
- **Serve as full partners in educational reform efforts by business and industries**



Grand Prix –

Faye Kinard, Mississippi Chemistry/Physics Teacher





Grand Prix –

Faye Kinard, Mississippi Chemistry/Physics Teacher

■ Objectives:

- Build a vehicle that can be propelled using the energy stored inside an inflated balloon.
- Work in a group to select the best properties of each individual car to produce a single best design.
- Produce a final design using the best features of all the cars.
- Build a car from the final design.
- Develop a logo for the car.



Grand Prix

■ Objectives:

- Test the car to determine the distance traveled.
- Determine the average velocity of the car from distance and time.
- Determine the average acceleration of the car.
- Determine the average forces acting on the car and the balloon.



Grand Prix

■ Workplace applications

- Students will work as a team to design, test and produce a product. Roles of team members include:
 - Project Manager
 - Engineer
 - Designer-Draftsperson
 - Quality Controller/Assembler
- The students will produce a list of all industry skills required to design, produce, test and market a wooden car kit propelled by a carbon dioxide cartridge.



Grand Prix

■ Workplace applications

- The students will produce a list of which classes they have taken to learn the skills identified for producing the car kit.
- The students will produce a list of various industry functional areas and teams required to produce and market the cars: i.e. research and design, manufacturing, human resources, marketing and quality control.
- The students will design a layout for a plant to produce an automobile.
- The students will design a container to hold the cars.



Grand Prix

- **Integration across the curriculum**
 - **Physics students will prepare the design and specification sheets for the cars.**
 - **Chemistry students will evaluate different types of paint to be used on the automobile.**
 - **Art and drafting students will work to prepare the industry logo and the drawing of the cars.**
 - **English students will produce a promotional scheme for selling the cars.**
 - **Computer science students will help design a web page to market the cars.**



Grand Prix

Resources

■ Printed Sources

- Hewitt, Paul. “Conceptual Physics” Chapter 2, Motion; Chapter 4, Newton’s Second Law of Motion-Force and Acceleration; Chapter 5, Newton’s Third Law of Motion – Action and Reaction; Chapter 8, Energy.
- Murphy, James T., Hollon, James Max, Zitzewitz, Paul W. “Physics: Principles & Problems”. Chapter 3, Motion in a Straight Line; Chapter 7, Motion in Two Dimensions; Chapter 10, Work, Power and Simple Machines.

■ Websites

- http://www.balloonhq.com/balloon_car/9.html
- <http://www.srv.net/~chris/gt.html>
- <http://www.ceeo.tufts.edu/graphics/VintageHills/ballooncar.html>
- http://www.alaska.faa.gov/flt_std/aved/teachers/Rcar.html



FLOAT YOUR BOAT –

Faye Kinard, Mississippi Chemistry/Physics Teacher

■ Objectives:

- Evaluate the effects of changing temperature on the products of a chemical reaction.
- Relate changes in energy to an increase in activation energy and the development of an activated complex.
- Use the relationship between mass and volume to calculate density based on changes in concentration and temperature.
- Explore the production of polymers and relate this to industrial processes.
- Graph the relationship between the independent and dependent variables in the experiment.



FLOAT YOUR BOAT

- **Applications in the Workplace:**
 - **Team work**
 - **Modeling of the injection molding process**
 - **Practice in measuring and evaluation the consequences of improper measuring**
 - **Effects of weather changes on the storage of raw materials**
 - **Experience in graphing techniques**



FLOAT YOUR BOAT

- **Integration across the curriculum:**
 - **Chemistry**
 - Measure and mix reactants
 - Determine mass and volume and calculate density
 - **Physics & Mathematics**
 - Use density values to calculate buoyancy
 - Graphing skills
 - **Art**
 - Decoration of boats



FLOAT YOUR BOAT

■ Resources:

- Flinn Scientific Inc. Chem-Fax Publication Number 270.10
- Hewitt, P. (2001). *Conceptual Physics*. Menlo Park, CA: Addison-Wesley Publishing Company, Inc.
- Murphy, J.T., Hollon, J.M., & Zitzewitz, P.W. (1995). *Physics: Principles & Problems*. Westerville, OH: Glencoe/McGraw-Hill.
- Tzimopoulos, Nicholas D., Metcalfe, H. Clark, Williams, John E., & Castka, Joseph. (1993). *Modern Chemistry*. Austin, Tx: Holt, Rinehart and Winston.



Designing an Outdoor Classroom: Incorporation of Framework - Patti Brooks, Mississippi Middle School Teacher



- *Determine measurements with a focus on real-world problems.*
- *Use a two-dimensional drawing to understand a three-dimensional object.*

- *Compare and contrast the structure and function of living things.*
- *Determine how organisms co-exists in their environment.*
- *Explore how environmental factors of a population influence the formation of an ecosystem.*





Building Bird Houses for Outdoor Classroom

*Measure
twice.*



*Cut
once.*



Keys to Developing Successful Partnerships



- Develop relationships – THE KEY!
- Identify existing and emerging industry strengths in the area
 - Mississippi – Transportation
 - Nissan, Toyota, Northrop Grumman, American Eurocopter, Aurora Flight Sciences
- Work with state and local economic development agencies and state and local chambers of commerce
- Identify key people in each industry



Developing Relationships

- Be knowledgeable and passionate
- Approach business and industry leaders with a commitment to learning their needs
- Learn real world applications of content from their perspective
- Communicate a strong desire to work with them to better prepare students for today's workforce



Developing Relationships

- Remember you are working in their world
- Visit their company
 - Dress code
 - Be on time
- Assess applications of STEM content in their context
- Communicate a strong desire to work with them to better prepare students for today's workforce



Developing Relationships

- Follow the companies' guidelines
- Continue to assess the value of the partnership to industry and to you
- Place industry representatives on your advisory boards
- Include industry representatives in your presentations and publications



Developing Relationships

- Take every opportunity to acknowledge and praise industry support
- Invite company representatives to functions associated with your school, college or university
 - Thank you for support
 - Update on progress
 - Assess progress
 - Discuss future collaborations



Developing Relationships

- PRODUCE and build TRUST

- Be honest
- Be sincere
- Have the appropriate attitude necessary for a true partnership
- Be prepared to assist industry when they request assistance



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