Illinois Counselor Conference

Presented by Terri Schulz
Director of State & Corporate Relations
November 19, 2008
PLTW is a 501(c)(3) not-for-profit organization.
The PLTW® Mission

Create dynamic partnerships with our nation’s schools to prepare an increasing and more diverse group of students to be successful in science, engineering and engineering technology programs.
Is there a need for engineers?
Future Engineering Need & Supply
This is true for the Power Industry as well…

Practicing Engineers
(USA)

1.3M*

Current Workforce

Need

How do We Fill the Gap?

2000 2010 2020

Years

The Boeing Company 1/28/05

* Note: Total workforce with Science & Engineering education exceeds 10M, 30+% work in S&E;
  Engineering accounts for 1.9M degrees and 1.3M working in the field, (NSF Science and Engineering Indicators 2000)
A Curricula Based Program that Provides:

Rigorous & Relevant Problem-based Curricula
(with end-of-course exams)

AND……

Rigorous & Relevant Professional Development
(for teachers and school counselors)
Middle School Program:
Gateway To Technology®

1. Design and Modeling™ (9 wks)
2. Automation and Robotics™ (9 wks)
3. The Magic of Electrons™ (9 wks)
4. The Science of Technology™ (9 wks)
5. Flight and Space™ (9 wks)
6. **Energy and the Environment™ (9 wks)

**to be developed
High School Course Program: Pathway To Engineering™

Foundation: Introduction to Engineering Design™
Principles of Engineering™
Digital Electronics™

Specialization: Computer Integrated Manufacturing™
and/or Civil Engineering and Architecture™
and/or Biotechnical Engineering™
and/or Aerospace Engineering™

Capstone: Engineering Design and Development™:
A course in Creativity & Innovation in Engineering

Note: This program requires college prep mathematics and science each year.
Activities, Projects, and Problems

What’s the Difference?
Activities, Projects, and Problems

Activities are written and designed to provide students the experience needed to acquire the skills they will use throughout a course.

Projects are written and designed to aid students in developing and beginning to apply critical thinking skills and knowledge.

Problems are written and designed to utilize all skills and knowledge acquired through activities and projects in an open-ended format that aids students in developing full understanding of the main concepts and principles of the course.
This is an example of an Activity

Using the diagram below and the equations listed, fill in the missing spaces on the table below. Be sure to show all work in the space provided under the chart.

$$MA = \frac{LE}{LR}$$

$$R = MA \times E$$

$$E = \frac{R}{MA}$$

<table>
<thead>
<tr>
<th>Load (R)</th>
<th>Resistance Arm (LR)</th>
<th>Effort Arm (LE)</th>
<th>Effort (E)</th>
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</thead>
<tbody>
<tr>
<td>2 feet</td>
<td>6 feet</td>
<td>1 lbs.</td>
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<td>8 lbs.</td>
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<td>50 lbs.</td>
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<td>113 lbs.</td>
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<td>1 foot</td>
<td>10 feet</td>
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<td>1 ton</td>
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# RIGOR / RELEVANCE FRAMEWORK

<table>
<thead>
<tr>
<th>Evaluation</th>
<th>6</th>
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<tbody>
<tr>
<td>Synthesis</td>
<td>5</td>
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<table>
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<tr>
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Adapted from W. Daggett

Application Model
Design and build a modifiable device that will launch a ping pong ball into a 10 inch bowl with 100% accuracy.

On launch day the distance will be varied by the instructor within a range of 5 to 15 feet.
## RIGOR / RELEVANCE FRAMEWORK

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### AP

- **High Rigor**
  - Low Context

### PLTW

- **High Rigor**
  - High Context

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Application Model
An example of Problem-Based Learning

From: *Digital Electronics™*

Design and build an electronic device to automatically measure the distance a person is away from the device.
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Application Model
Benefits of Project Lead The Way® Curriculum

- Course updates are generated by teachers of Project Lead The Way® programs for their use
- Course materials are complete, which allows the teacher to focus on:
  - Teaching
  - Student achievement
  - Assessment (i.e., formative and summative)
  - Professional Development
Based on Research

How People Learn
by the National Research Council

Understanding by Design
by the Wiggins & McTighe

Achieving Rigor & Relevance
Through Project-Based Learning
by the Daggett & Blais

ABET Accreditation Criteria

National Standards
What does an integrated *Project* or *Problem* look like?
Design Process

Activities give the students what they need to traverse the “phases” in a design process.

Projects and Problems utilize the design process itself.

Example of a design process
AP² - Activities

Activities

- Used as class work or homework
- Designed to build skills and knowledge through canned exercises

Example from Principles Of Engineering™
Activities may be word-problems, software exercises or tutorials, experiments, reading assignments, etc.
AP² - Projects

- More rigorous and open-ended than activities
- Utilize prescribed problem statements, goals, and constraints
- Require the application of skills and knowledge

Example taken from Civil Engineering and Architecture™
AP² - Projects

- Have outcomes that fall within a predictable range, but are still diverse and creative
- Tend to be long-term (weeks or months)
- Often involve student teams

Example taken from Civil Engineering and Architecture™
AP² - Problems

- Usually instigated by a question, a theme, or a need
- Students determine their own criteria
- Require students to create design briefs

Example problem from a 2002-03 Engineering Design and Development™ class
AP² - Problems

- Require extensive research
- Have students synthesizing new knowledge
- Require students to work with, not for their instructors
- Have higher failure risk

Example problem from a 2002-03 Engineering Design and Development™ class
Professional Development
3-Phase Professional Development

Pre-STI Assessment & Remediation

Core Training
Summer Training Institute (STI)

- Gateway To Technology® (Middle School)
- Principles Of Engineering™
- Introduction To Engineering Design™
- Digital Electronics™
- Computer Integrated Manufacturing™
- Civil Engineering/Architecture™
- Aerospace Engineering™
- Biotechnical Engineering™
- Engineering Design and Development™

Continuous Training

Level II Training

Virtual Academy

Ready for core training

Ready for teaching
How are we doing?
Nationally Recognized Program

RECOMMENDATIONS:

- **Model K-12 curriculum materials on world class standards**
- **Foster high quality teaching with world class curricula, standards, & assessments of student learning**
- **Convene a national panel to collect, evaluate, and develop rigorous K-12 materials that are available, free of charge, as a voluntary national curriculum.**

PLTW® programs are recommended as the model.
Student Achievement

Data Significant at .05 level in reading and math
Data Significant at .001 in science

Source: Special Analysis of 2004 HSTW Assessment Data
Over 90% of seniors in PLTW® courses said they had a clear and confident sense of the types of college majors and jobs they intended to pursue and their experiences in the PLTW® program were very significant in developing this self-knowledge....
Over 97% of seniors in PLTW® courses plan to attend a university, college or community college, compared with 67% for average seniors.

80% say they will study engineering, technology or computer science.

Seniors in PLTW® courses
Average Seniors
KEY FINDINGS

- Native American and Hispanic students, while widely under-represented in mathematics and science nationwide, are proportionately represented in PLTW.
- African-American students are attracted to the PLTW engineering program at a rate greater than college engineering, but not proportional to their overall enrollment.
- The proportion of female students in PLTW engineering programs remained at 17%, the same as are attracted to college engineering study.
- Male and female student achievement on end-of-course examinations were equivalent in all courses.
- PLTW® programs are found in schools across all socioeconomic levels.
PLTW® Network
2008 – 2009 Academic Year

- Districts: 1,600+
- High Schools: 2,000+
- Middle Schools: 900+
- Total Schools: 2,900+
- Total teachers trained: 7,000
- Total counselors trained: 5,000
- Total students enrolled in PLTW® courses: 250,000
Growth of School in PLTW Network

Growth in Schools offering PLTW® Program

Year


0 500 1,000 1,500 2,000 2,500 3,000