Using Project-Based Learning to Increase Student Engagement and Understanding

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Project-based Learning

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2121 Collective
Talking Points

- What is Project-based Learning?
- Student Engagement
- The Role of Technology
“In an increasingly complex world, sometimes old questions require new answers.”
What is Project-based Learning?
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A systemic teaching method that engages students in learning essential knowledge and skills through an extended, student-influenced inquiry process structured around complex, authentic questions and carefully designed tasks and products.
Webster’s

- A specific plan or design
- A planned undertaking
- A task or problem engaged in usually by a group of students to supplement and apply classroom studies
Some Products of Real World Projects
It’s About the Process

Problem, Issue, Task

Learning Experiences

Products

Standards
Essential Components of PBL

- Problem, issue, or task that drives the project
- Learning experiences organized around the problem which as a whole make up the project
- Culminating product that addresses
The Process Engages Students

Technology Integration
Teacher PBL Presentations
The Planning Process

- Real World starts at home
- Don’t overwhelm the standards
- Continually assess understanding
STEM Skills

- Analytical skills to research a topic, develop a project plan and timeline, and draw conclusions from research results.

- Science skills to break down a complex scientific system into smaller parts, recognize cause and effect relationships, and defend opinions using facts.

- Mathematic skills for calculations and measurements.

- Attention to detail to follow a standard blueprint, record data accurately, or write instructions.

- Technical skills to troubleshoot the source of a problem, repair a machine or debug an operating system, and computer capabilities to stay current on appropriate software and equipment.
STEM Skills

Communication and cooperation skills to listen to customer needs or interact with project partners.

Creative abilities to solve problems and develop new ideas.

Leadership skills to lead projects or help customers.

Organization skills to keep track of lots of different information.
Boredom
Thank You!
Project Based Learning

Bill Church
Littleton High School
Littleton, NH
...where students come to watch teachers work hard.” -- ??

Video: “That old pair of jeans”, Fatboy Slim
Project Based Learning
Everybody is out of their seats!
Talking, Sharing, Doing
Measurement and Analysis
Measurement and Analysis
3D Modeling
3D Modeling
3D Modeling
Classroom OUT in the world
Classroom OUT in the world
The world comes to the classroom
Up to our elbows in Science!
Share with other teachers
Thank you!

Bill Church
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Background
Steps of the Engineering Design Process

1. Identify the Need or Problem
2. Research the Need or Problem
3. Develop Possible Solution(s)
4. Select the Best Possible Solution(s)
5. Construct a Prototype
6. Test and Evaluate the Solution(s)
7. Communicate the Solution(s)
8. Redesign

Redesign back to 1.
Why Wind Power?

• Local Catholic High School recently erected a wind turbine.
• Nantucket Sound “wind farm” issue.
• Wal-Mart wind mills in their parking lot.
The Holy Name Wind Turbine visible from most of Worcester, Mass
The student teams

Team Green

Team Awesome
The teachers involved in our STEM elective; Jackie Bonneau and Tom Regeles
Students look at designs

The old - Holland

The new - Europe
Can we learn from wind farms along the highway?

Can we learn from garden pinwheels?
Students review some primary source information on the Holy Name wind turbine’s design decisions.
Procedures from existing texts were reviewed and revised.
Construction
Students make initial decisions.

• Students decide on what to test.
  – Initially axis orientation.
  – Also considered angles of blades.

• Students decide on what to use for materials.

• Students decide on how to test; what variables to control.
Horizontal axis – the most common here

Vertical axis – another option
Students review the “kit” parts to decide what to use, what to test, and what else they need.
Initial construction was out of cardboard because it was easy to manipulate and less costly.
Testing
Anemometers measured initial wind speed were used as a controlled variable.
Students use log Books to document designs, testing results and iterations.
Early success for Team Green, encourages students to iterate material and angle rather than basic design.
Photogates measured blade speed in the horizontal design model.
Multiple probes are used in testing
Testing had to involve controlled variables such as wind speed and distance. Students quickly agreed on the parameters for this as the need was apparent.
Iteration
New Design
Construction of that new design was not easy. It required different material and lots of manipulating.
The new design pays off for team awesome. Material limitations however become apparent very quickly.
Does angle matter, if so what is “best”? 
Use of other materials required more tools and skills
New blades of balsa wood; more rigid to hold shape and angle, lightweight.
Success
Although success was measured in watts, equally important was the excitement of other students coming and watching.
Testing of new blades, new materials and angles.
A lot of Physics was learned by “accident”, it was GREAT!

Using Nspire they measure voltage and current and calculate power.
Lights out – lights on !!!
WHERE WOULD WE PUT A WIND TURBINE HERE ON OUR LOCATION?

Location
Students measure wind in the parking lot in many spots and directions.

Yes, we have wind here, but how much and in what direction?
Students measure wind in the parking garage in many spots and directions.

Safety net anyone?
Students enter summative data for analysis.