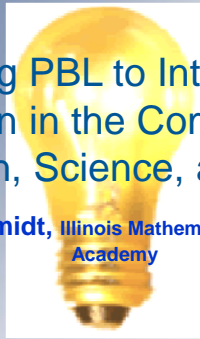


Using PBL to Integrate Instruction in the Common Core in Math, Science, and ELA



Kathy Schmidt, Illinois Mathematics and Science Academy



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World Areas Supported by PBLNetwork



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- South Korea
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- Arizona
- Colorado
- Connecticut
- Florida
- Georgia
- Idaho
- Illinois
- Indiana
- Iowa
- Kentucky
- Louisiana
- Massachusetts
- Michigan
- Missouri
- Montana
- Nebraska
- Nevada
- New Jersey
- New York
- North Dakota
- Ohio
- Oklahoma
- Pennsylvania
- South Carolina
- Tennessee
- Texas
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- Virginia
- Washington
- Washington D.C.
- West Virginia
- Wisconsin



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How Learning Happens:

Think of something you've learned well....

How did that happen?



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How Learning Happens:

- Hands on experience
- Need/desire to know
- Enthusiasm and passion
- Self-interest
- Trial and error
- Family/social
- Practice
- Some prior knowledge
- Failure leads to improvement
- Teaching others
- Watching experts
- Break into smaller steps
- Feedback and reflection



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Learner's Perspective of the PBL Process



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JIM ALLSOPP
METEOROLOGIST, NATIONAL WEATHER SERVICE

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Identify Know and Need to Know

Know	Need to Know	Need to Do

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Define the Problem

	Here's what I think ...	Here's what we (pair) think ...	Here's what our group thinks ...
Overall Task			
Factors to Consider			

How can we...
in such a way that we consider...

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Teacher's Perspective of the PBL Process



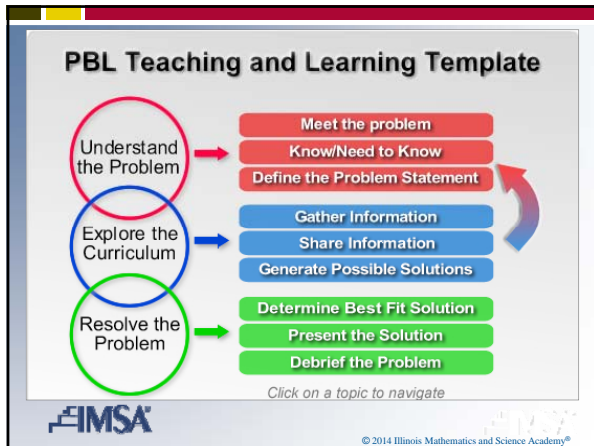
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Prepare the Learners

Teachers pave the way for PBL by establishing a classroom environment conducive to collaboration.



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Meet the Problem

Students encounter a messy problem that engages their interest and compels them to need to know more.

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Identify Know and Need to Know

Know

- Have to give a presentation on this
- We need to use less water.
- We can't live without water.
- 36 inches of rain fall in Chicago/year
- 70% of the globe is water
- 95% of the water in the world is salt water
- Our source of water is the Gulf of Mexico
- We use a lot of water by drinking, showering, washing dishes, etc. not how much
- If we're careless we may run out of H₂O

The group generates lists:

- ✓What we know
- ✓What we need to know
- ✓What we need to do

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Define the Problem

Students list the **Task** to be completed and the **Factors** for successful completion.

We, the Summer Scientists are going to create a solution to the water shortage, in a way that we envision

Population
Ethics
MATH based
Runner
Purifier
Weather
*Conservation
Legal

How can we give Mr. A answers to how to get a "0" water footprint (use)

In such a way that we consider

- how much H₂O is used
- clean water/contaminants
- preventing drought
- where water comes from

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Plan for Information Gathering

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Gather Information

Learners gather information from multiple and varied resources to resolve their need to know.

Share Information

Students share information they have gathered with their group and discuss its relevance to the problem.

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Gather and Share Information Internet Research

Internet Research

- reliable sources (gov, gov.gov)
- look @ sites critically
- take notes on only what you need to know
- not advanced search
- no. people who

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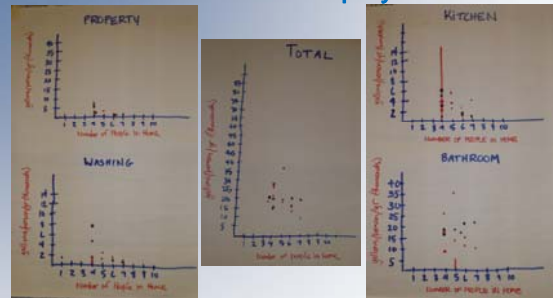
Gather and Share Information Hands-on Inquiry

Water Quality

different filters = different jobs

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Gather and Share Information Hands-on Inquiry



Gather and Share Information Experts

NOAA

NATIONAL WEATHER SERVICE

NASA

U.S. SILICA

FOX CHICAGO WFLD

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Refine Problem Statement

How can we give Mr. A answers to how to get a "0" water footprint (use) In such a way that we consider

- how much H₂O is used
- clean water/contaminants
- preventing drought
- where water comes from

How can we give Mr. A answers to how to get a "zero water footprint" In such a way that we consider

- How much H₂O is used
- clean water/contaminants
- preventing drought
- where water comes from
- conservation

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Generate Solution Elements

Students synthesize the information to find solution elements which fit the factors in their problem statement.

ways to save water

- use bath water to flush toilets
- catch rain water (in barrels) for watering lawns
- water from sump pumps to be saved - water leaks
- stepped water pricing - price goes up as you use more water
- collect water from lawns etc.

presentation

- ways to get more water
- make a ZWF
- protect remaining water
- Make press based on - math/science ethics
- WAYS TO FIX DROUGHT TO NOAA
- present discuss drought - how much they can save
- bring solutions - how much they can save
- Stop polluting

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Determine Best Fit Solution

Students develop a graphic organizer to find a solution which fits the factors in their problem statement.

SWOT Analysis

- Strengths
- Weaknesses
- Opportunities
- Threats

Decision Matrix

- Pros
- Cons
- Long-term effects

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Present the Solution

Students present their solution to and get feedback from a real-world stakeholder in the problem.

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Debrief . . . the Presentation

Learners debrief the presentation to emphasize learning from other groups' presentations.

"I loved how we were able to bring the information that we learn in class to the real world. It made us think outside of the box and it was something that none of my teachers have ever done before."

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Debrief . . . the Problem

Learners debrief the problem and the process to emphasize the curriculum and group skills learned.

I liked that this unit called for a lot of thinking and creativity ... this unit made us use all parts of our brain and then mix it together to find solutions.

I liked how it was a real-world situation/challenge. It was logical problem solving for a worthwhile cause.

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Stages of PBL, Science and Engineering Practices, Mathematical Practices, and College and Career Readiness in Reading, Writing, Speaking, Listening, and Language

Stage of PBL	Science and Engineering Practices	Mathematical Practices	College and Career Readiness in ELA
Meet the Problem	Ask Questions and Define Problems; Obtain, Evaluate, and Communicate Information	Make Sense of Problems and Persevere in Solving Them	Comprehend as Well as Critique; Come to Understand Other Perspectives and Cultures
Identify Know/Need to Know	Plan and Carry Out Investigations; Obtain, Evaluate, and Communicate Information	Make Sense of Problems and Persevere in Solving Them	Value Evidence
Define the Problem Statement	Ask Questions and Define Problems	Make Sense of Problems and Persevere in Solving Them	Respond to Varying Demands of Audience, Task, Purpose, and Discipline; Comprehend as Well as Critique; Come to Understand Other Perspectives and Cultures
Gather Information	Plan and Carry Out Investigations; Analyze and Interpret Data; Use Mathematics and Computational Thinking; Engage in Arguments from Evidence; Obtain, Evaluate, and Communicate Information	Make Sense of Problems and Persevere in Solving Them; Model with Mathematics; Use Appropriate Tools Strategically; Look for and Express Regularity in Repeated Reasoning	Demonstrate Independence; Build Strong Content Knowledge; Respond to Varying Demands of Audience, Task, Purpose, and Discipline; Comprehend as Well as Critique; Value Evidence; Use Technology and Digital Media Strategically and Capably
Share Information	Ask Questions and Define Problems; Develop and Use Models; Plan and Carry Out Investigations; Analyze and Interpret Data; Use Mathematics and Computational Thinking; Construct Explanations and Design Solutions; Engage in Arguments from Evidence; Obtain, Evaluate, and Communicate Information	Make Sense of Problems and Persevere in Solving Them; Reason Abstractly and Quantitatively; Construct Viable Arguments and Critique the Reasoning of Others; Model with Mathematics; Attend to Precision; Look for and Express Regularity in Repeated Reasoning	Demonstrate Independence; Build Strong Content Knowledge; Respond to Varying Demands of Audience, Task, Purpose, and Discipline; Comprehend as Well as Critique; Value Evidence; Use Technology and Digital Media Strategically and Capably

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Stage of PBL	Science and Engineering Practices	Mathematical Practices	College and Career Readiness in ELA
Generate Possible Solutions	Ask Questions and Define Problems; Develop and Use Models; Plan and Carry Out Investigations; Analyze and Interpret Data; Use Mathematics and Computational Thinking; Construct Explanations and Design Solutions; Engage in Arguments from Evidence; Obtain, Evaluate, and Communicate Information	Make Sense of Problems and Persevere in Solving Them; Construct Viable Arguments and Critique the Reasoning of Others; Model with Mathematics; Use Appropriate Tools Strategically; Look for and Make Use of Structure	Comprehend as Well as Critique; Value Evidence
Determine Best Fit Solution	Ask Questions and Define Problems; Develop and Use Models; Analyze and Interpret Data; Use Mathematics and Computational Thinking; Construct Explanations and Design Solutions; Engage in Arguments from Evidence; Obtain, Evaluate, and Communicate Information	Make Sense of Problems and Persevere in Solving Them; Reason Abstractly and Quantitatively; Construct Viable Arguments and Critique the Reasoning of Others; Model with Mathematics; Use Appropriate Tools Strategically; Attend to Precision; Look for and Make Use of Structure; Look for and Express Regularity in Repeated Reasoning	Respond to Varying Demands of Audience, Task, Purpose, and Discipline; Comprehend as Well as Critique; Value Evidence
Present the Solution	Develop and Use Models; Analyze and Interpret Data; Use Mathematics and Computational Thinking; Construct Explanations and Design Solutions; Engage in Arguments from Evidence; Obtain, Evaluate, and Communicate Information	Reason Abstractly and Quantitatively; Construct Viable Arguments and Critique the Reasoning of Others; Model with Mathematics; Use Appropriate Tools Strategically; Attend to Precision; Look for and Express Regularity in Repeated Reasoning	Demonstrate Independence; Build Strong Content Knowledge; Respond to Varying Demands of Audience, Task, Purpose, and Discipline; Comprehend as Well as Critique; Value Evidence; Use Technology and Digital Media Strategically and Capably; Come to Understand Other Perspectives and Cultures
Debrief the Problem	Construct Explanations and Design Solutions; Engage in Arguments from Evidence; Obtain, Evaluate, and Communicate Information	Construct Viable Arguments and Critique the Reasoning of Others; Look for and Make Use of Structure	Comprehend as Well as Critique; Value Evidence

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PBL Resources

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