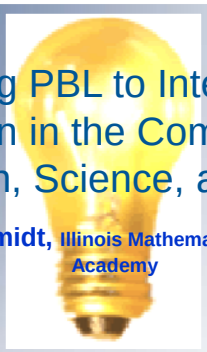
Using PBL to Integrate Instruction in the Common Core in Math, Science, and ELA



Kathy Schmidt, Illinois Mathematics and Science Academy

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- New York
- North Dakota
- Ohio
- Oklahoma
- Pennsylvania
- South Carolina
- Tennessee
- Texas
- Utah
- Virginia
- Washington
- Washington D.C.
- West Virginia
- Wisconsin

How Learning Happens:

Think of something you've learned well….

How did that happen?

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

Learner's Perspective of the PBL Process

Identify Know and Need to Know

Know	Need to Know	Need to Do

Define the Problem

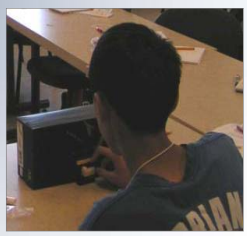
	Here's what I think . . .	Here's what we (pair) think . . .	Here's what our group thinks . . .
Overall Task			
Factors to Consider			

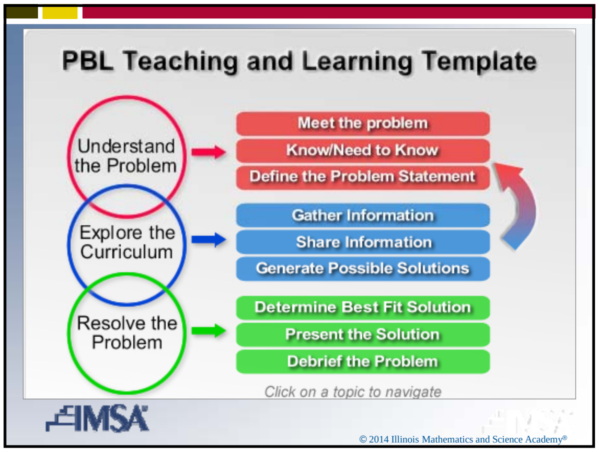
How can we…
in such a way that we consider…

Teacher's Perspective of the PBL Process

Prepare the Learners

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




PBL Teaching and Learning Template
Understand the Problem
Explore the Curriculum
Resolve the Problem
Meet the problem
Know/Need to Know
Define the Problem Statement
Gather Information
Share Information
Generate Possible Solutions
Determine Best Fit Solution
Present the Solution
Debrief the Problem
Click on a topic to navigate
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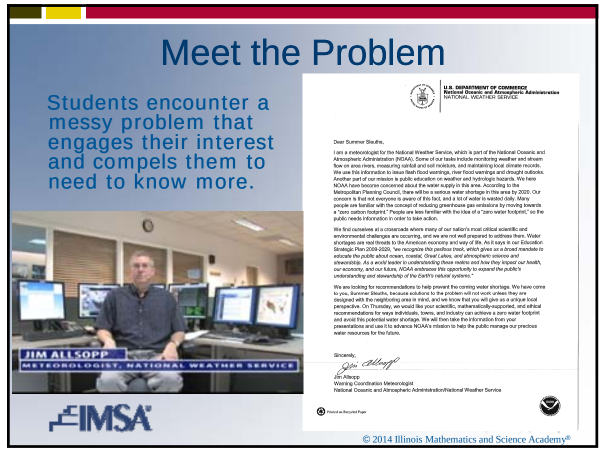
Meet the Problem
Students encounter a messy problem that engages their interest and compels them to need to know more.
JIM ALLSOPP
METEOROLOGIST, NATIONAL WEATHER SERVICE
IMSA
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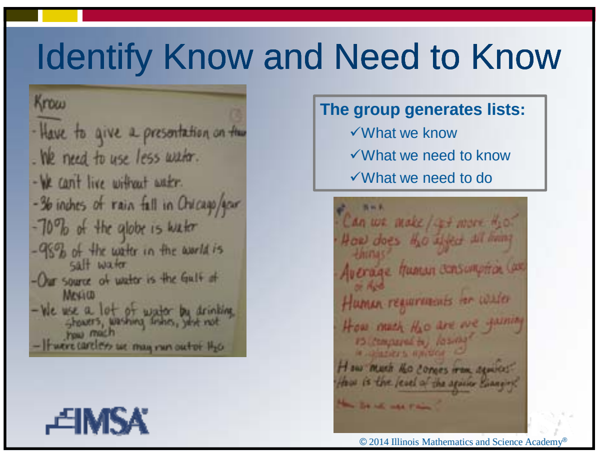
Identify Know and Need to Know
Know
- Have to give a presentation on
. We need to use less water.
- We can't live without water.
- 36 inches of rain fall in Chicago/year
- 70% of the globe is water
- 98% of the water in the world is salt water
- Our source of water is the Gulf of Mexico
- We use a lot of water by drinking, showers, washing dishes, but 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
Can we make/get more H2O?
How does H2O affect all living things?
Average human consumption
Human requirements for water
How much H2O are we gaining (compared to) losing?
How much H2O comes from aquifers?
How is the level of the aquifer changing?
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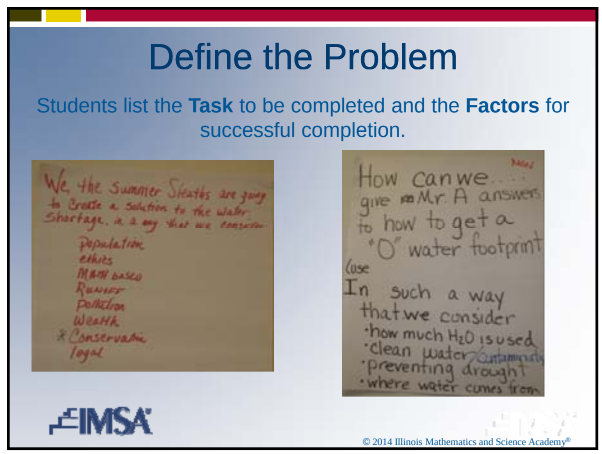
Define the Problem
Students list the Task to be completed and the Factors for successful completion.
We, the Summer Sleuths are going to create a solution to the water shortage, in a way that we consider
Population
ethics
Conservation
legal
How can we give Mr. A answers to how to get a "O" water footprint
In such a way that we consider
·how much H2O is used
·clean water
·preventing drought
·where water comes from
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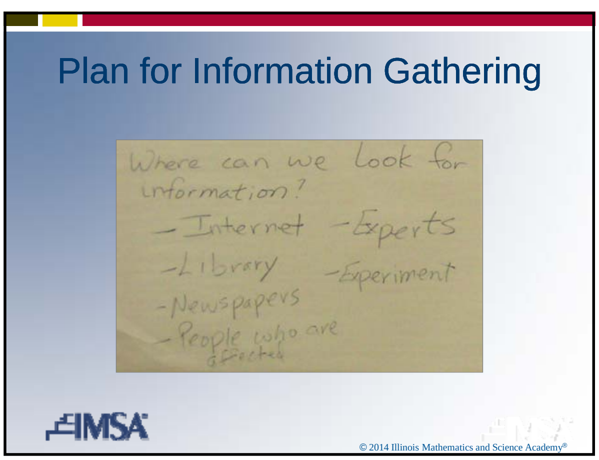
Plan for Information Gathering
Where can we look for information?
- Internet
- Experts
- Library
- Experiment
- Newspapers
- People who are affected
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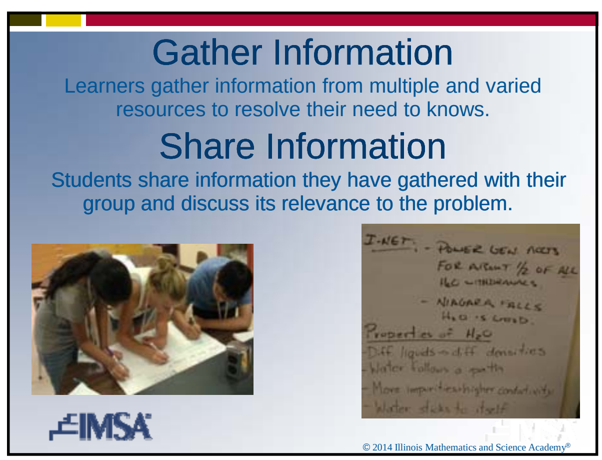
Gather Information
Learners gather information from multiple and varied resources to resolve their need to knows.
Share Information
Students share information they have gathered with their group and discuss its relevance to the problem.
I-NET:
- POWER GEN ACCTS FOR ABOUT ½ OF ALL H2O WITHDRAWALS
- NIAGARA FALLS H2O IS GOOD.
Properties of H2O
- Diff liquids → diff densities
- Water follows a path
- More impurities → higher conductivity
- Water sticks to itself
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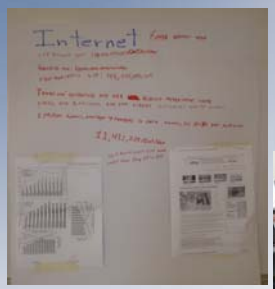
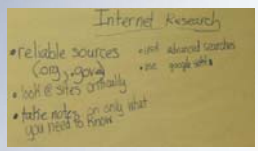
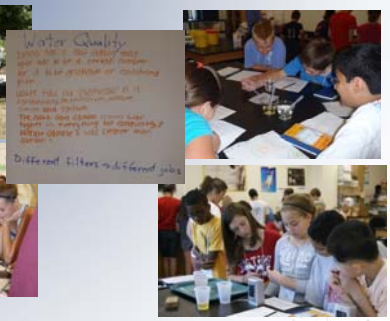
Gather and Share Information
Internet Research





Gather and Share Information
Hands-on Inquiry



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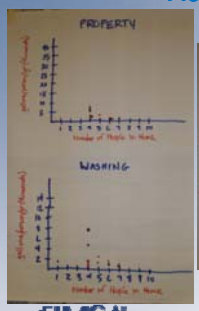
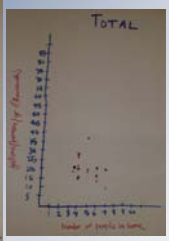
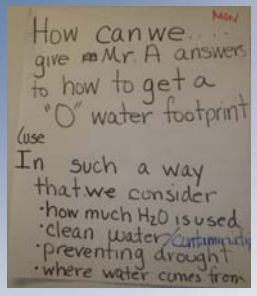
Hands-on Inquiry

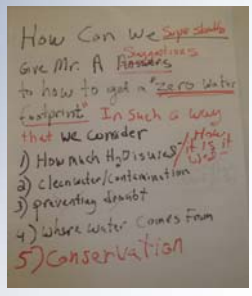




Gather and Share Information
Experts

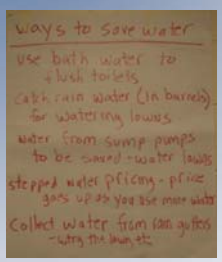
Refine Problem Statement

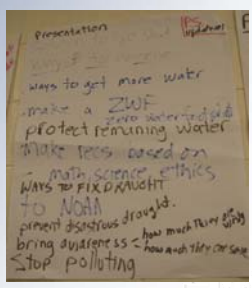




Generate Solution Elements

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



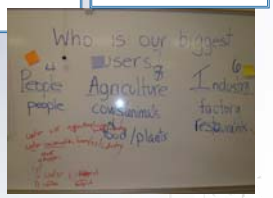


Determine Best Fit Solution

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

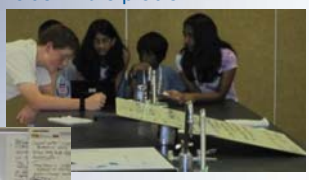
SWOT Analysis
- **S**trengths
- **W**eaknesses
- **O**pportunities
- **T**hreats

Decision Matrix
- Pros
- Cons
- Long-term effects



Present the Solution

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



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."

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.

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

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
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	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
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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

PBL Resources

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http://pbln.imsa.edu