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

Kathy Schmidt, Illinois Mathematics and Science Academy

How Learning Happens:
Think of something you’ve learned well....

How did that happen?

• Residential Student Program
  A world class powerhouse for inspiring, challenging and nurturing talented students who will use their exceptional abilities to improve people’s lives.

• Professional Field Services
  Provide research-based, practice proven programs to transform mathematics and science education across Illinois and beyond.

Partners in Student Pathways

IMSA FUSION

IMSA Great Minds Program

World Areas Supported by PBLNetwork

- Australia
- Canada
- China
- France
- Hong Kong
- Mexico
- Pakistan
- Singapore
- South Korea
- Alabama
- 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
- Utah
- Virginia
- Washington
- Washington D.C.
- West Virginia
- Wisconsin

• 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

<table>
<thead>
<tr>
<th>Know</th>
<th>Need to Know</th>
<th>Need to Do</th>
</tr>
</thead>
</table>

Define the Problem

Overall Task

<table>
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<tr>
<th>Here’s what I think...</th>
<th>Here’s what we (pair) think...</th>
<th>Here’s what our group thinks...</th>
</tr>
</thead>
</table>

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.
Meet the Problem

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

Identify Know and Need to Know

The group generates lists:
- What we know
- What we need to know
- What we need to do

Define the Problem

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

Plan for Information Gathering

Where can we look for information?
- Internet
- Experts
- Library
- Experiment
- People who are experts

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.
Gather and Share Information

Internet Research

Hands-on Inquiry

Experts

Refine Problem Statement

Generate Solution Elements

Students synthesize the information to find solution elements which fit the factors in their problem statement.
### Stages of PBL, Science and Engineering Practices, Mathematical Practices, and College and Career Readiness in Reading, Writing, Speaking, Listening, and Language

<table>
<thead>
<tr>
<th>Region of PBL</th>
<th>Science and Engineering Practices</th>
<th>Mathematical Practices</th>
<th>College and Career Readiness in Reading, Writing, Speaking, Listening, and Language</th>
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<tbody>
<tr>
<td>Math Problem</td>
<td>Determine Best Fit Solution</td>
<td>SWOT Analysis</td>
<td>Students develop a graphic organizer to find a solution which fits the factors in their problem statement.</td>
</tr>
</tbody>
</table>
|                |                                  | Decision Matrix        | • Strengths  
• Weaknesses  
• Opportunities  
• Threats |

**SWOT Analysis**
- **Strengths**
- **Weaknesses**
- **Opportunities**
- **Threats**

**Decision Matrix**
- **Pros**
- **Cons**
- **Long-term effects**

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<tr>
<th>Math Problem</th>
<th>Identify Know/Need to Define the Problem</th>
<th>Share Information</th>
<th>Debrief... the Presentation</th>
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<td></td>
<td>Students identify what they know, need to define, and are ready to define.</td>
<td>Students develop a graphic organizer to find a solution which fits the factors in their problem statement.</td>
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<td>Learners are encouraged to think outside of the box and to bring the information to other groups’ presentations.</td>
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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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<th>Math Problem</th>
<th>Present the Solution</th>
<th>Debrief... the Problem</th>
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<td>Students present their solution to and get feedback from a real-world stakeholder in the problem.</td>
<td>Learners debrief the problem and the process to emphasize the curriculum and group skills learned.</td>
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<tr>
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<td>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.</td>
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<td>I liked how it was a real-world situation/challenge. It was logical problem solving for a worthwhile cause.</td>
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**Debrief... the Problem**

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

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

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http://pbln.imsa.edu