Project-Based Science

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Southwest Plains Regional Service Center
Launching Your Thinking about PBL

- Introductions
- College Credit
- 10:00 Special Guest
  - Melissa Bigge: Nutrients for Life
- Lunch
- Time to plan---1:30-2:30
Objectives for the Day

- Begin your thinking about Project-Based Learning
- Clarify some non-negotiables for PBL
- Build a community of learners who will continue to collaborate
- Begin to plan for at least one project for this spring or next fall
What has science looked like in the past?

- Textbooks
- Films/videos
- “Experiments”
- THE Scientific method
- Tests that emphasize memorizing
What COULD a science class look like?
Cognitive Dissonance

• Controlled investigations
  • Experiments as we have known them in the past (variables, etc.)

• Open investigations
  • Discuss examples
The Nature of Science

Scientific Method (1 serving)

1. Ask a question.
2. Formulate a hypothesis.
3. Perform experiment.
4. Collect data.
5. Draw conclusions.

Bake until thoroughly cooked.
Garnish with additional observations.
Nature of Science

• Science is a way of knowing
• Science is a human endeavor
• Science addresses questions about the natural and material world
• **Scientific knowledge is based on a variety of methods**
• Science laws, models, mechanisms, and theories explain natural phenomena

• Scientific knowledge is based on empirical evidence

• Scientific knowledge is open to revision in light of new evidence

• Scientific knowledge assumes an order and consistency in natural systems
http://undsci.berkeley.edu/article/0_0_0/howscienceworks_02

• Take a look at each of the circles
• Take a look at the grade-span lessons bottom right side
Mystery Tubes
Mystery Tube

• Focus question: **What does the inside of the tube look like?**
• Record observations about these tubes (**Create a chart**)
• From your observations, **draw the inside of the tube.**
• Are you doing science?
• Are all the tubes alike?
Mystery Tube

- Focus question: **What does the inside of the tube look like?**
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Consider Guided Writing

- I observed_________________.
- I think that ______________ because___________________.
- I also think___________________.
- In addition I think_______________.
- My evidence is ___________________.


So what is Project-Based Learning?
From the Buck Institute for Education

- https://www.bie.org/object/video/project_based_learning_explained
Why Project Based Learning (PBL)?

- https://www.bie.org/about/why_pbl

- **Main points from the article:**
  - Backed by research
  - Improves learning—makes school more engaging
  - Makes students college, career, and world ready
  - Addresses standards
  - Encourages use of technology
  - IT IS JUST FUN!
How is this different from a typical class project?

7 steps to successful PBL

STEP 1: Involve your students from the beginning
STEP 2: Break down the topic into well defined tasks
STEP 3: Plan well, set goals, define outcomes
STEP 4: Divide your class into working groups with well defined tasks
STEP 5: Create a tangible artifact as an outcome
STEP 6: Arrive at a conclusion
STEP 7: Document and present to a public audience
Kindergarten and NGSS

- https://www.youtube.com/watch?v=08D0dBGIzYQ 6:28
Forces and Interactions
K-PS2-2

• Rollin’ Rollin’ Rollin’
  • Focus question: How can we make the ball roll in different directions?
Watch and Think
Signal if you want to stop!

• [https://www.youtube.com/watch?v=hnzCGNnU_WM](https://www.youtube.com/watch?v=hnzCGNnU_WM) Key component for PBLs also talks about formative assessment 6:30 minutes

• [https://www.youtube.com/watch?v=mAYh4nWUkU0](https://www.youtube.com/watch?v=mAYh4nWUkU0) Inquiry science

Cross Cutting Concepts

- Patterns.
- Cause and Effect.
- Scale, Proportion, and Quantity.
- Systems and System Models.
- Structure and Function.
- Stability and Change of Systems.
Where do I get the driving questions?
Where do I get ideas for projects?

- From the kids----What is a bird’s favorite color?
- From Sharon Springs---What will it take to make our restroom ADA compliant?
- www.newsela.com
- Tweentribune
- Mystery Science—aligned
- AC2E Science Notebooks
Forces and Interactions

3-PS2-1

How does force impact an object?

Marshmallow Shooter!

1. Cut out the bottom of a cup.
2. Cut the tip off the balloon.
3. Stretch the balloon over the cup, then tie a knot.
Energy
4-PS3-4

- What questions could you explore?
From NSTA Reports

- See Blick on Flicks
- Inside out
- The Martian
- The Ant-Man
- Hidden Figures

- Teach kids how to do an observation
What questions can kids ask?
Describe a typical food chain for the herbivores, carnivores, and omnivores in the deciduous forest biome.

Describe the important portions of the Constitution and summarize why it is a living document.

What is an environmental brown field and describe why they are difficult to use?

Name the various reasons that the American Colonists declared war with England

Can we design a menu for the storybook animals that live in the forest?

How can we create a public service announcement for TV showing why the Constitution is still important today?

How can we convince the park department that the old oil field near the beach could be valuable?

Can we create a play that would convince the colonist in our hometown to declare war on England?

From the Standards

- iPad app for NGSS
Disciplinary Core Ideas

- That’s the science!!!! If you are not as knowledgeable as you would like to be—use the DCIs, ask your upper grade colleagues, connect to an expert, challenge your students to help you research.
Project-Based Learning—It’s not just for science!

- Remember CCRSS ELA—students should ask
- Compelling questions from HGSS—example from 5th Grade

**Sample Compelling Questions**

- How do people decide where to live? (Standard 1)
- What were the rights and responsibilities of men and women in an American Indian cultural group? (Standard 2)
- How were American Indian cultural groups shaped by beliefs and ideas? (Standard 3)
- What causes people to change the way they live? (Standard 4)
- Why were natural resources a common cause of conflict among American Indian cultural groups? (Standard 5)
Relevance

More ideas!

http://www.bie.org/project_search/results/search&channel=project_search&category=330&category=331&ps_first=330&ps_second=331

Project Search

The projects you will find here have been curated by BIE and were gathered from online project libraries. If any of the links don’t work go directly to the organization’s website. These projects are meant to inspire your own ideas or may be adapted to fit the needs of your classroom.

Search by:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Common Core (ELA)</th>
<th>Common Core (Math)</th>
<th>Keywords</th>
</tr>
</thead>
</table>

43 results found in "Science, Elementary".

Refine your search:

- All Sources
- Science (203)
- Elementary (43)
How to Write Driving Questions

• See article---Handout
How do I refine the questions?

- http://www.bie.org/object/video/the_birth_of_the_tubric

Now you try!!
1. Title
(what is your investigation about?)

2. Aim
(what are you trying to find out?)

My aim is to find out

I am going to investigate

3. Equipment
(What are you going to use?)

I will need to use the following equipment:

4. Prediction
(what do you think will happen?)

I predict that
I think this will happen because

5. Risk Assessment
(what will I do to be safe?)

6. Method
Firstly I will collect the equipment in my equipment list and set it up as shown in the diagram.

2. Then I will________
3. Next I will________
And so on

Keywords
<table>
<thead>
<tr>
<th>Change</th>
<th>Variable</th>
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<tbody>
<tr>
<td>Time</td>
<td>Method</td>
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<tr>
<td>Measure</td>
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<td>Observe</td>
<td>Safety</td>
</tr>
<tr>
<td>Reaction</td>
<td>Goggles</td>
</tr>
<tr>
<td>Units</td>
<td>Table</td>
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Why are you using that equipment — justify your choice.
Form: Report
Language: Form
Audience: Teenage
Language: Scientific

1. Analysis
(What do your results show?)
My results show that

The graph shows that

2. Conclusion
(What have you found out?)
I have found out _________

Connectives Bank
However
But
Although
Therefore
So
Because
Nevertheless
Although
On the other hand
Despite
Whereas
In addition
Evidence for this is

Point: What is your point?
Evidence: Select evidence to back up your point
Analysis: Explain how the evidence proves your point

3. Evaluation
(How can you improve your investigation?)
What equipment might have worked better?
How would you do it better if you were to do it again?

Stretch
What does your graph show?
Are there any results that don’t fit? (anomalous results)
Why did you take repeats?
What is the scientific reason for your results?

Word Bank
Anomalous — a result that doesn’t fit the pattern
Independent variable — the thing you choose to change, e.g. amount of water
Dependent variable — the thing that you measure, e.g. time taken to heat up

Justify — giving reason for your statement or choice
What is holding schools back from teaching science?
Go Fund Me

https://www.gofundme.com/education
Thank you packet must be submitted when the grant is fully funded
SCIENCE AS INQUIRY

https://www.youtube.com/watch?v=mAYh4nWUkU0

5:25
Consider

• What is empirical evidence?

• https://www.youtube.com/watch?v=H7LHsL0iB_w
STEAM school 6:00 minutes right at the end there is a bullet of high achievement in reading/math.
You will need to teach the soft skills

- Start with cooperative learning structures or ideas from *Total Participation Techniques*
- Plus ELA Standards
Project Based Learning

How do I know if I am doing it right?

with Amy Mayer
Brainstorm Ideas/Plan a Project
Thanks for your time!

- Please go to www.swprsc.org ---then Professional Learning ---then Workshop Evaluation