Making the Common Core Real: Middle School Science, Problem-Based Learning, and the Common Core

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Slides available on Royal Fireworks Press website
http://www.rfwp.com
An Aside
NEW Research Study on MCT
*Word Within A Word*

Royal Fireworks Press is looking for **16 classrooms**.

8 middle or high school teachers of gifted students *who have used WWW for three or more years*.

8 middle or high school teachers of gifted students *who are not using WWW*.

Students will take Practice SAT-V, Sentence Completion Test, and Learning/Language Attitude Survey. *No more than two class periods, total.*

Teachers will be asked to complete a brief survey about their teaching practices.

ALL participating teachers will receive up to $495.00 of materials of their choice from Royal Fireworks Press.

For more information or to be considered for the study, please contact Royal Fireworks Press [mail@rfwp.com](mailto:mail@rfwp.com) or Dr. Shelagh Gallagher [sgallagher5@carolina.rr.com](mailto:sgallagher5@carolina.rr.com)
COMMON CORE

*meaningful* education

an UNIMAGINABLE future
Over the course of a year of office practice—which, by definition, excludes the patients seen in the hospital—physicians each evaluated an average of 250 different primary diseases and conditions. Their patients had more than 900 other active medial problems that had to be taken into account.

Atul Gawande
The new age of science is marked by the *dissolution of barriers across traditional disciplines* and fields. Scientists are grouping and regrouping not based on similarity in background, but to ensure that diverse perspectives are considered.

Lewis Thomas
passionate, engaged
life long learners
from

gifted STUDENTS
creative EXPERTS
Stage 1: Romance
You start to notice what's around you, and you get very curious about how things work. How things interrelate. It's as simple as seeing a bug that intrigues you. You want to know where it goes at night; who its friends are; what it eats. *David Cronenberg*
The most exciting phrase to hear in science, the one that heralds the most discoveries is not ‘Eureka!’ (I found it!) but ‘That’s funny...’.
Wherever we look upon this earth, the opportunities take shape within problems

Nelson Rockefeller
Stage 2: Precision
There is a tremendous amount of work that you have to do to get your idea to come to life. But you’re not going to do that work if you don’t have the idea; if you don’t have that inspiration, that love.

I didn’t know that you could not improve the fibers easily through plant breeding; I thought it would be fairly straightforward and then WHAM, it’s extremely complex. But by then I was hooked.

Sally Fox, Entomologist
Stage 3: Generalization
Creating a new theory is not like destroying an old barn and erecting a skyscraper in its place. It is rather like climbing a mountain, gaining new and wider views, discovering unexpected connections between our starting points and its rich environment. But the point from which we started out still exists and …forms a tiny part of our broad view gained by the mastery of the obstacles on our adventurous way up.

Albert Einstein.
a different approach
Welcome to the Prairie!
<table>
<thead>
<tr>
<th>What do we know?</th>
<th>What are our Learning Issues?</th>
<th>What is our Action Plan?</th>
</tr>
</thead>
</table>

Hunches:

Wednesday, November 28, 12
Teacher Reference

Prairie Ecosystem Template

Instructions: Complete the chart with pictures or descriptions of each element of the prairie ecosystem. Include the black-footed ferret and the prairie dog, along with at least one producer and one food source. Label elements using scientific terminology.

Climate: 12.6 inches of rain/year
Sunny, little or no shade from trees
What is “Problem-Based Learning”?

A form of inquiry-based education, originally invented for medical school, where learning is initiated with an ill-structured problem and students learn to direct their own course of study.
Goals of Problem-Based Learning

- Core Content
- Problem Solving
- Conceptual Reasoning
- Research
- Dispositions
- Thinking Skills
- Ethics
Key Components of PBL

- Initiating Instruction with an Ill-Structured Problem
- Student-as-Stakeholder
- Teacher as (Metacognitive) Coach
The Ill-Structured Problem

- Needs more information before it becomes clear
- Can be solved in more than one way
- Has more than one resolution
- Changes sometimes with new information
- Is ambiguous and unclear
- STIMULATES QUESTIONS
Student-As-Stakeholder

- Real world problem solvers are not objective
- Increases ownership
- Provides a form of apprenticeship in a discipline
The PBL “Coach”

- Cruise Director

- Socrates
Engagement

Inquiry and Investigation

Problem Definition

Problem Resolution

Problem Debriefing

The Flow of the Problem
Laying out the Plan...

**Problem Engagement**
1. The BFFRIT

**Inquiry and Investigation**
1. Ferret Facts (research)
2. Habitat Threats
3. Systems and Risk
4. What’s the Source
5. Problem Definition

**Resolution**
1. The Model
2. Presentation

**Debriefing**
1. Review/Reflect/Extend

(Ferret Math)

(Genetic Bottleneck)
# Goals for *Ferret it Out*

<table>
<thead>
<tr>
<th>PBL Goal</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content</td>
<td>Habitats, Food Web, Biomes, Genetic Drift, Human Impact</td>
</tr>
<tr>
<td>Concept</td>
<td>Systems</td>
</tr>
<tr>
<td>Research</td>
<td>Primary Resources, Modeling</td>
</tr>
<tr>
<td>Dispositions</td>
<td>Perspective</td>
</tr>
<tr>
<td>Thinking Skills</td>
<td>Cause-Effect, Risk Assessment, Problem Solving</td>
</tr>
<tr>
<td>Ethics</td>
<td>Competing Needs</td>
</tr>
</tbody>
</table>
Embedded Instruction

- Research Skills
  - Internet Search
  - Primary Resources
- Analysis
  - Comparing/Contrasting Points of View
  - Cause and Effect
- Creating Criteria
- Comparing Options
COMMON CORE
<table>
<thead>
<tr>
<th>Text Types and Purposes</th>
<th>Standard</th>
<th><em>Ferret it Out</em></th>
<th>Lesson &amp; Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Write arguments to support claims with clear reasons and relevant evidence.</strong></td>
<td>Students use research evidence to support their point of view about a variety of issues in the problem</td>
<td><em>Ferret Facts Reflective Moment Threats to the Habitat What are the Cause(s) Creating the Model</em></td>
<td></td>
</tr>
<tr>
<td><strong>Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.</strong></td>
<td>Students write a letter to the editor explaining and justifying their model.</td>
<td><em>Update memo Presentation letter to the editor</em></td>
<td></td>
</tr>
<tr>
<td><strong>Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose and audience.</strong></td>
<td>Students write a memo to their supervisor (Mitchell Ladner) and a letter to the editor</td>
<td><em>Update memo Presentation letter to the editor</em></td>
<td></td>
</tr>
<tr>
<td><strong>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.</strong></td>
<td>Students generate questions to research on the Learning Issues Board and then conduct research to investigate their questions using a variety of resources, including print, audio and video-based resources.</td>
<td><em>The Black-Footed Ferret Recovery Re-introduction Team Genetic Bottleneck</em></td>
<td></td>
</tr>
<tr>
<td><strong>Draw evidence from literary or information texts to support analysis, reflection and research.</strong></td>
<td>Students provide factual evidence to support their thinking about the problem.</td>
<td><em>Reflective Moments throughout the unit</em></td>
<td></td>
</tr>
</tbody>
</table>
Date:
To: All Team Members
From: Mitchell Ladner, US Fish and Wildlife Service
Subject: Ft. Collins Project

By now your work is well underway on this project. I would like to know about your findings, your ideas about the direction we should take to optimize the success of our reintroduction efforts, and a description of any issues you’ve encountered thus far. Please send me a written response with your thoughts to date. I’ll expect your update by tomorrow.

Problem Log

Reflective Moment: A Letter to the Boss

Write a letter to Mitchell Ladner providing him with the requested update.

A quality response includes: 1) a header 2) a salutation, 3) a body of at least two paragraphs, each presenting a major idea that is supported by facts, and 4) a closing.
<table>
<thead>
<tr>
<th>Common Core Standards for Literacy in Science and Technical Subjects</th>
<th>Ferret it Out</th>
<th>Lessons &amp; Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Key Ideas and Details</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cite specific textual evidence to support analysis of science and technical texts</td>
<td>Students select evidence that supports different interpretations of the problem. Students select facts think are important to the problem and defend.</td>
<td>What are the Cause(s) Reflective Moments throughout the unit</td>
</tr>
<tr>
<td>Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.</td>
<td>Students provide central ideas of research regarding the short grass prairie and share ideas during discussion. Students distinguish between facts and opinions regarding the prairie dog.</td>
<td>Ferret Facts What are the Cause(s)</td>
</tr>
<tr>
<td>Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.</td>
<td>Students follow procedures of genetic bottleneck simulation.</td>
<td>Genetic Bottleneck</td>
</tr>
<tr>
<td><strong>Craft and Structure</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.</td>
<td>Students determine meaning of symbols and terms on maps and other scientific content related to unit. Students use the language related to ecosystems and biomes.</td>
<td>Ferret Facts The Ferret Habitat Threats to the Habitat</td>
</tr>
<tr>
<td>Analyze the structure an author uses to organize a text, including low the major sections contribute to the whole and to an understanding of the topic.</td>
<td>Students analyze structure and purpose of one or more research articles (choice).</td>
<td>Ferret Fact Reflective Moment</td>
</tr>
<tr>
<td>Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.</td>
<td>Students analyze an article, including use of facts and persuasive techniques, to determine author’s purpose.</td>
<td>Ferret Fact Reflective Moment Kicker–Rancher, Home-owner</td>
</tr>
<tr>
<td><strong>Integration of Knowledge and Ideas</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).</td>
<td>Students integrate statistics related to ferret and prairie dog populations, and data from articles in description of model.</td>
<td>Ferret Facts Threats to the Habitat What are the Cause(s) Problem Definition Creating the Model</td>
</tr>
<tr>
<td>Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.</td>
<td>Students analyze an article, including use of facts and persuasive techniques, to determine author’s purpose. Students distinguish between fact and opinions regarding the black-footed ferret and prairie dog.</td>
<td>Ferret Facts What are the Cause(s) Threats to the Habitat Creating the Model</td>
</tr>
<tr>
<td>Comprehension and Collaboration</td>
<td>Standard</td>
<td>Ferret it Out</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Engage effectively in a range of collaborative discussions, ...building on others’ ideas and expressing their own clearly.</td>
<td>Students discuss their questions, research findings and ideas for solutions.</td>
<td>The Black-Footed Ferret Recovery Reintroduction team Ferret Facts What are the Cause(s) Problem Definition Building the Model</td>
</tr>
<tr>
<td>Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.</td>
<td>Students analyze one of the articles they find during their research into the black-footed ferret.</td>
<td>Ferret Facts</td>
</tr>
<tr>
<td>Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.</td>
<td>Students present their model habitat to an audience. The Presentation Rubric supports appropriate presentation style.</td>
<td>Presentation</td>
</tr>
</tbody>
</table>
Literacy in Science and Technical Subjects

Cite specific textual evidence to support analysis of science and technical texts.

Learning Issue Question: ____________________________________________

MLA CITATION STYLE:
Last name, First name. “Title of Work.” Source. City of Publication: Publisher, Year.

Type (circle one): Book Magazine Website Other ________________________

(Include PAGE NUMBERS in your notes, especially if you write down a QUOTATION from the text).

1. Citation: ____________________________________________

_________________________________________________________

Information Related to my Question: ____________________________________________

_________________________________________________________

_________________________________________________________

_________________________________________________________

_________________________________________________________
Literacy in Science and Technical Subjects

Analyze the author’s purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

Problem Log

Reflective Moment: Deeper Analysis

Briefly respond to one of the questions below. Place an ‘x’ by the question answered.

___ Select one article and identify: 1) the main purpose, 2) three key facts, 3) an inference or speculation. Then discuss: is the author trying to be objective or persuasive? Is the article effective in making you think differently about some aspect of the problem? How?

___ Compare information you gathered from a video and information you gathered from print sources. What is the value of each? What are the limitations of each?

A quality response: 1) addresses the question, 2) stays on topic, 3) is plausible or reasonable, and 4) provides facts to support and clarify your ideas.

Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
Ferret It Out
A Problem about Endangered Species and Animal Ecosystems

Teacher Manual
Sheilagh A. Gallagher

SCIENCE!

Wednesday, November 28, 12

Fort CollinsColoradoan
by Tamara Roberts

Fire Ravages McClintock Farm

Scorching temperatures and drought conditions created a recipe for disaster yesterday afternoon for one of Ft. Collins' oldest whitelabel ranches. Ranch hands at McClintock Farm report that just before noon they noticed thick, black smoke rolling up from the western edge of the property. Prairie Fire Authority, along with Union Colony Fire and Rescue were dispatched and arrived on the scene within a matter of minutes. Firefighters worked tirelessly to control the conflagration, but weather conditions were not on their side. It took over six hours to control the blaze, and when firefighters were finally able to extinguish it over 2,400 acres of land had been blackened. Captain Jonathan Evans said, "We tried as best we could to contain the fire quickly, but with the heat and the abundance of dry grass we were fighting an uphill battle. Ranch owner, Cliff Montes, said that he was thankful for the efforts of hard working firefighters."

PIR: Page 13

Juror's Award of Excellence Goes to Global Warming

Prairie Ecosystem Template

Instructions: Complete the chart with pictures or descriptions of each element of the prairie ecosystem. Include the black-footed ferret and the prairie dog, along with at least one other predator and one food source. Label elements using scientific terminology.

Climate: 12.6 inches of rain/year
Sunny, little or no shade from trees

Edaphic
Producer:
Grasses

Heterotroph
Primary
Carnivore
Black-footed ferret

Saprotroph
Decomposer

Heterotroph
Secondary
Carnivore
Coyote

Prairie Ecosystem of the World

Grassland Biomes of the World
Genetic Bottleneck Demonstration

### Teacher Reference

The Genetic Bottleneck Data Sample #1

Directions: Complete this chart to create a model of what happens when there is a dramatic decrease in an animal population. Draw a bead from your bag without looking, mark the color, and then replace the bead before drawing again. Do this 20 times each for Generation 5, Generation 6 and Generation 7. For Generation 8, where the population begins to recover, draw 40 beads, using the same method as described above.

<table>
<thead>
<tr>
<th>Trait/Color</th>
<th>Generation 1</th>
<th>Generation 2</th>
<th>Generation 3</th>
<th>Generation 4</th>
<th>Generation 5</th>
<th>Generation 6</th>
<th>Generation 7</th>
<th>Generation 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dark Blue</td>
<td>10</td>
<td>10</td>
<td>12</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2. Light Blue</td>
<td>10</td>
<td>8</td>
<td>11</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3. Orange</td>
<td>10</td>
<td>7</td>
<td>8</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4. Red</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5. White</td>
<td>10</td>
<td>7</td>
<td>7</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>11</td>
</tr>
<tr>
<td>6. Light Green</td>
<td>10</td>
<td>14</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7. Dark Green</td>
<td>10</td>
<td>14</td>
<td>17</td>
<td>14</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>8. Purple</td>
<td>10</td>
<td>18</td>
<td>15</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>9. Yellow</td>
<td>10</td>
<td>12</td>
<td>9</td>
<td>11</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>10. Black</td>
<td>10</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Math!

Problem Log

Two Ferrets and 200 Prairie Dogs on 13.34 Acres

111

Key
Ferret
Prairie Dog

Problem Log

Two Ferrets and Prairie Dogs after Plague Epidemic

112

Key
Ferret
Prairie Dog
Critical thinking!

**Problem Log**

Determining Causes

*Directions:* Use this space to record the cause-effect relationships among the Critical Components from the Black-Footed Ferrit Habitat Chart. Use arrows to connect each fact to its prior cause. If there is a Critical Component that you think is important, but not directly connected, included in the chart but don’t connect it to other Critical Components. Feel free to add boxes as needed.

<table>
<thead>
<tr>
<th>Distant Causes</th>
<th>Prior Causes</th>
<th>Immediate Causes</th>
<th>Current Situation</th>
</tr>
</thead>
</table>

![Diagram](image-url)
**Critical Thinking!**

Example: Why did some children start living away from home in order to work?

**Indirect Causes**
- Ferrets killed
- Inadequate food source
- Prairie dogs killed
- Plague
- Changed ecosystem

**Indirect Causes**
- Genetic bottleneck
- Too much inbreeding
- Not enough prairie dogs
- Inadequate food source

**Immediate Causes**
- Weakened condition
- Inadequate food source

**Current Condition**
- Ferret does not thrive when reintroduced into the wild.
**Speaking and Listening Standards**

*Present claims and findings, emphasizing salient points in a focused, coherent manner, with pertinent descriptions, facts, details, ...*

### Presentation Rubric

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Exemplary</th>
<th>At Standard</th>
<th>In Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Visuals</strong></td>
<td><em>Visually are relevant and add to the viewer’s understanding of the topic</em></td>
<td><em>Visually are related to the topic</em></td>
<td><em>Visually are not relevant or nonexistent</em></td>
</tr>
<tr>
<td><strong>Use of Information</strong></td>
<td><em>Information is accurate, and detail shows understanding of complex ideas</em></td>
<td><em>Information is accurate and is sufficiently detailed</em></td>
<td><em>Information is inaccurate or vague</em></td>
</tr>
<tr>
<td></td>
<td><em>Information is relevant to assignment and is of high quality</em></td>
<td><em>Information is sufficient and generally relevant</em></td>
<td><em>Information is insufficient and/or irrelevant</em></td>
</tr>
<tr>
<td><strong>Use of Sources</strong></td>
<td><em>Information is relevant to assignment and is of high quality</em></td>
<td><em>Gathers information from correct number of relevant sources</em></td>
<td><em>Gathers information from irrelevant, low-quality sources</em></td>
</tr>
<tr>
<td></td>
<td><em>Identifies and discusses bias in own data</em></td>
<td><em>Identifies bias at the most basic level</em></td>
<td><em>Does not discuss possible bias</em></td>
</tr>
<tr>
<td><strong>Presenter Quality</strong></td>
<td><em>Uses conversational tone and obviously understand material thoroughly</em></td>
<td><em>Speaks from notes or memory using a comfortable tone; shows basic understanding</em></td>
<td><em>Reads from notes and shows little or no understanding</em></td>
</tr>
<tr>
<td></td>
<td><em>Poised and confident</em></td>
<td><em>Generally poised and confident</em></td>
<td><em>Appears indifferent, anxious, or nervous</em></td>
</tr>
<tr>
<td></td>
<td><em>Answers questions clearly and thoroughly</em></td>
<td><em>Responds to most questions with clarity</em></td>
<td><em>Does not know answers to questions</em></td>
</tr>
<tr>
<td><strong>Collaboration (If applicable)</strong></td>
<td><em>Shares time equitably with colleagues</em></td>
<td><em>Shares time but runs over or takes others’ points</em></td>
<td><em>Runs overtime and/or makes other presenters’ points</em></td>
</tr>
<tr>
<td></td>
<td><em>Listens respectfully when not speaking</em></td>
<td><em>Listens most of the time</em></td>
<td><em>Does not listen, whispers during other presentations</em></td>
</tr>
<tr>
<td><strong>Overall Presentation Quality</strong></td>
<td><em>Presentation is well-organized and is structured to be interesting</em></td>
<td><em>Presentation is organized and fulfills all aspects of the assignment; organization is logical</em></td>
<td><em>Presentation is not organized and does not fulfill all aspects of the assignment</em></td>
</tr>
</tbody>
</table>
Problem Narrative: The Story of Ferret it Out

Ideally, the direction of a Problem-Based Learning unit is decided by the students and through the questions they ask. To some extent, this is made manageable by the structure of the opening scenario presented during Problem Engagement. The opening scenario is carefully designed to point students in the direction of some predictable questions. For example, it would be hard to avoid asking questions about the First Amendment, the rights of teachers, or precedent court cases. The narrative below and the lesson plans in this unit respond to these more predictable questions and address other desirable learning outcomes. They also provide a helpful guide for teachers new to PBL.

Experienced PBL teachers are encouraged to use this unit as a framework, selecting lessons that fit the students’ questions (and, as above, many should fit), and adding other lessons to address other questions.

Problem Engagement

The students are in the stakeholder role of a member of the Black-Footed Ferret Recovery Implementation team tasked with creating a model habitat using Ft. Collins, Colorado as a test site. The team receives a memo from their boss complaining that interest in the ferret is waning. Attached to the memo is a newspaper article about the ferret that validates those fears (while the ‘team members’ probably will not recognize this yet, a majority of the other articles in the newspaper also connect to the problem of reintroducing the black-footed ferret—making this newspaper a useful touchstone throughout the unit). The team must research the critical elements necessary for optimizing successful reintroduction of the ferrets, and give their presentation to members of the BFFRIT Project Oversight Committee.

Key Questions to Answer
- Why do the ferrets need to be reintroduced?
- What is the Black Footed Ferret Recovery Implementation Team and what is its goal?
- What are the critical habitat elements needed for successful reintroductions?
- What, if anything, needs to change about the test site before reintroduction can begin?
- What needs to be considered to account for the fragility of the black-footed ferret?
- What kinds of things need to be included in the model?

Inquiry and Investigation

Students will then begin reviewing the various learning issues associated with the current problem. As they work they will begin to gain a greater understanding of the fragility of the black-footed ferret and the complex ecosystem in which it lives. Exploration of the ferret’s genetic bottleneck will reveal the long-term impact of limiting the size of any species. They will also come to realize that, fragile or not, the ferret cannot survive unless there is also a thriving prairie dog community on which to feed.

The need for a substantial prairie dog population opens the door to another dimension of the problem, euphemistically referred to as the “human climate.” Ranchers are not fond of prairie dogs, because the believe prairie dogs interfere with cattle grazing. Students have a chance to test this belief through their research. They also do not like prairie dogs because they are prone to disease, including canine distemper and bubonic plague. That natural elements such as plague or invasive prairie grass threaten the prairie dogs becomes yet another dimension of the problem.

Problem Log

Fort Collins
Colorado

Fire Ravages McClintock Farm

By Skai Harris

Severe temperatures and drought conditions created a recipe for disaster yesterday afternoon for one of Ft. Collins' oldest established ranches. Ranch hand at McClintock Farm report that just before noon they noticed thick, black smoke trailing up from the western edge of the property. Pueblo Fire Authority along with Union Colony Fire and Resce were dispatched and arrived on the scene within a matter of minutes. Firefighters worked tirelessly to control the conflagration, but weather conditions were not on their side. It took over six hours to control the blaze, and when firefighters were finally able to extinguish it over 2,000 acres of land had been blackened. Captain Anthony Ramirez stated, "We tried as best we could to contain the fire quickly, but with the heat and the abundance of cheat grass we were fighting an uphill battle.

Ranch owner, Clay Murphy, said that he was thankful for the efforts of hard working firefighters.

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Plink, Poison or Proliferate: What to do about the Prairie Dog

For such a small creature, the prairie dog certainly believes that prairie dogs are ruining the public ever be reached?

Juror's Award of Excellence Goes to Global Warming

See P. 36
Engaging in RESEARCH, WRITING, SPEAKING and LISTENING
Systems

Elements of a system must all operate in appropriate balance and proportion.

When one element of a system is at risk, the entire system is at risk.

Elements of a system must all function correctly, or the system will break down.
Engaging for ALL

Differentiated for Gifted

Habitats

Biomes

Endangered Species

Research

Communication

Metacognitive Reflection

Advanced Conceptual Reasoning

Long Range Thinking

Intended and Unintended Consequences

Interdisciplinary Understanding
Compared to other forms of learning in this class, did you like Problem-Based Learning more, less, the same or “it depends.” Please explain why you feel the way you do, providing enough detail that someone can tell where you’re coming from.

Engagement

Compared to other forms of learning in this class, did you like Problem-Based Learning more, less, the same, or “it depends.” Please explain why you feel the way you do, providing enough detail that someone can tell where you’re coming from.

I like Problem-Based Learning more because it gives me more motivation to come to a solution. It is also fun to work with others towards a common goal and solution.
I found that this ferret unit really made me interested in science and the world! It made me eager to come to science class every day!

Let us be creative.
**Authentic Learning**

Compared to other forms of learning in this class, did you like Problem-Based Learning more, less, the same, or 'it depends.' Please explain why you feel the way you do, providing enough detail that someone can tell where you're coming from.

<table>
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<th>More, because I loved how it showed you what your real job could look like. The project not only taught us the material, but also taught us important life and business skills.</th>
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This was something real people are working on and some of us got pretty passionate about it.

Gave us a modern, real-life topic, allowed us to find realistic solutions that could make a difference.

It was an actual problem to solve. You couldn’t just turn on the computer and find the answer.
Authentic Learning/Problem Solving

Helped me realize how we **solve problems today**/in the adult world.

I learned that not everything can be fixed with **duct tape**.

It actually **challenged** us to **think** and solve problems.
Self-Directed Learning

Compared to other forms of learning in this class, did you like Problem-Based Learning more, less, the same, or ‘it depends.’ Please explain why you feel the way you do, providing enough detail that someone can tell where you’re coming from.

I liked problem based learning better than other forms. I liked how you were independent and had to figure everything out yourself. It was interesting and I learned a lot.
Self-Directed Learning

It was fun to be able to have control of a solution and think for myself. Learning about the human side of it all helped me think deeply.

You don’t feel like you are learning but you are, you also remember the important parts better than by just studying. We didn’t have to purposely memorize everything we learned but soaked up the information so we could solve the problem.
Comprehension

Compared to other forms of learning in this class, did you like Problem-Based Learning more, less, the same, or ‘it depends.’ Please explain why you feel the way you do, providing enough detail that someone can tell where you’re coming from.

I enjoyed problem-based learning because it forces you to catch on quickly and do your share of the work.
It was deeper than just learning from the textbook. It helped me understand interactions in ecosystems better. I also liked how the problem led to learning about other things, like niches.

We were learning two things without knowing it. Everything we learned was connected and easy to understand.

I learned how there are many different points of view, it got me to think.
Overall, on a pretest given prior to the unit the students’ average score was 70%.
Post-test data

Avg % Post-Test

Teacher 1
Teacher 2
Teacher 3

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To Know them is to Love Them…

PBL Resources

- William and Mary Science Units  [www.kendallhunt.com](http://www.kendallhunt.com)
- ASCD Materials
Thompson’s Truths about Curriculum

• The more academic learning is, the less academic it seems
• Students acts as hero willing to become an unknown self
• Creates a quake in the state of assumptions
• Cognition without imagination is shallow
• Phasing of engagement and scholarship