

Problem -Based Learning 101: Using the Power of Story to Drive the Curriculum



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1.

The **ONLY** Reason
to

Alter Curriculum

for Gifted Students

Their LEARNING NEEDS are **DIFFERENT**

because

THEY are **DIFFERENT**



The Gifted Mind

**Rapid Learning
Conceptual Thinking
Inquiry
Intensity/Openness**

2.

BECAUSE

they are **DIFFERENT**

our **GOALS** are

Different

What are the Aims of Gifted Education?

A Journey to Expertise

Knowledge

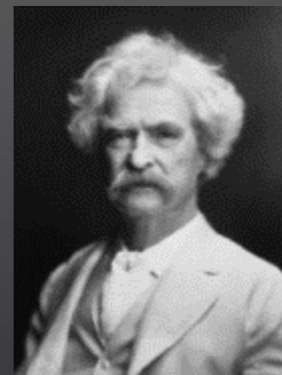
Thinking Skills

Problem-Solving

Metacognition

Tolerance for Ambiguity

Passion



Expertise requires a

DEEP DIVE

that

CANNOT

be achieved through

differentiated lessons alone

Curriculum IS a

DEEP DIVE

the consideration of

a significant idea

that grows and changes as

understanding evolves



<http://www.blackfootedferret.org/>

Department of the Interior
U.S. Fish and Wildlife Service

To: All Team Members, Black-Footed Ferret Recovery Reintroduction Team (BFFRRT)
From: Mitchell Ladner, U.S. Fish and Wildlife Service
Subject: Fort Collins Project

Progress on the reintroduction of the black-footed ferret into natural habitats is not moving quickly enough. Already there is media coverage suggesting that attempts to save the black-footed ferret are too expensive and too labor-intensive, given our minimal successes so far. Just look at the recent edition of *The Fort Collins Coloradoan*, and you'll see what I mean—the project was buried on page 4! Given the current strains on the economy, we need to make sure our efforts show decisive results.

Clearly something has to change, and that is why you have been brought together as a team. In the past we have been reactive—that is, we have responded to different problems as they have cropped up. I think it is important that we become proactive by anticipating potential problems and by creating a model of a feasible, functioning habitat that's suitable for the black-footed ferret and all other inhabitants.

We will use the Fort Collins, Colorado, region as the test site to develop our model habitat. Your job is to identify the different aspects of successful black-footed ferret reintroduction, paying particular attention to these questions:

1. How suitable is the natural habitat for black-footed ferret preservation? What, if anything, needs to change before we begin reintroduction?
2. What in particular needs to happen to the Fort Collins habitat to account for any changes the black-footed ferrets might experience as a result of the genetic bottleneck?
3. What is the nature of the “human climate” with regard to the black-footed ferret? Identify any necessary changes in that area and provide ideas on how the changes can be made.

These questions should be enough to at least get you started, but remember, you may encounter other unexpected factors along the way. Keep track of these and incorporate them into your model as appropriate. You will be presenting the model and findings to members of the BFFRRT Project Oversight Committee at its meeting in about two weeks.

I realize that this is a complex task, but I am confident that, given the nature and diversity of the membership of this group, you will be successful. With continued effort, the black-footed ferret will be able to once again fill its niche in the prairie ecosystem.

Learning Issues Board

Hunches: Their habitats isn't suitable

What do we know?

What are our Learning Issues?

What is our Action Plan?

- *Ferrets are in danger
- *We've been trying to save, too expensive too much work according to the Ft. Collins paper
- *We are the BFFRRT
- *We have not been very successful
- *The human climate is bad
- *The article was on page 4 of the paper
- *We are supposed to create a model ecosystem for Ft. Collins
- *We have two weeks

- *What does a BFF need for survival?
- *What is the habitat of a BFF?
- *How much has the habitat changed since the ferret pop declined?
- *Why the population declined?
- *What happened to the environ to cause the decline
- *How have other populations been impacted?
- *What is the impact of the BFF disappearance on the ecosys?
- *What were the successes?
- *What is TOO expensive/labor?
- *What does success look like?
- *What is a genetic bottleneck?
- *What is the "human climate?"

Learning Issues Board

Hunches: Their habitats isn't suitable

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What are our Learning Issues?

- *What does a BFF need for survival?
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- *What is the impact of the BFF disappearance on the ecosys?
- *What were the successes?
- *What is TOO expensive/labor?
- *What does success look like?
- *What is a genetic bottleneck?
- *What is the "human climate?"

What is our Action Plan?

Group 1: Research BFF needs with an internet search

Group 2: Look at maps, science books, videos to determine habitat

Group 3: Call local zoologist

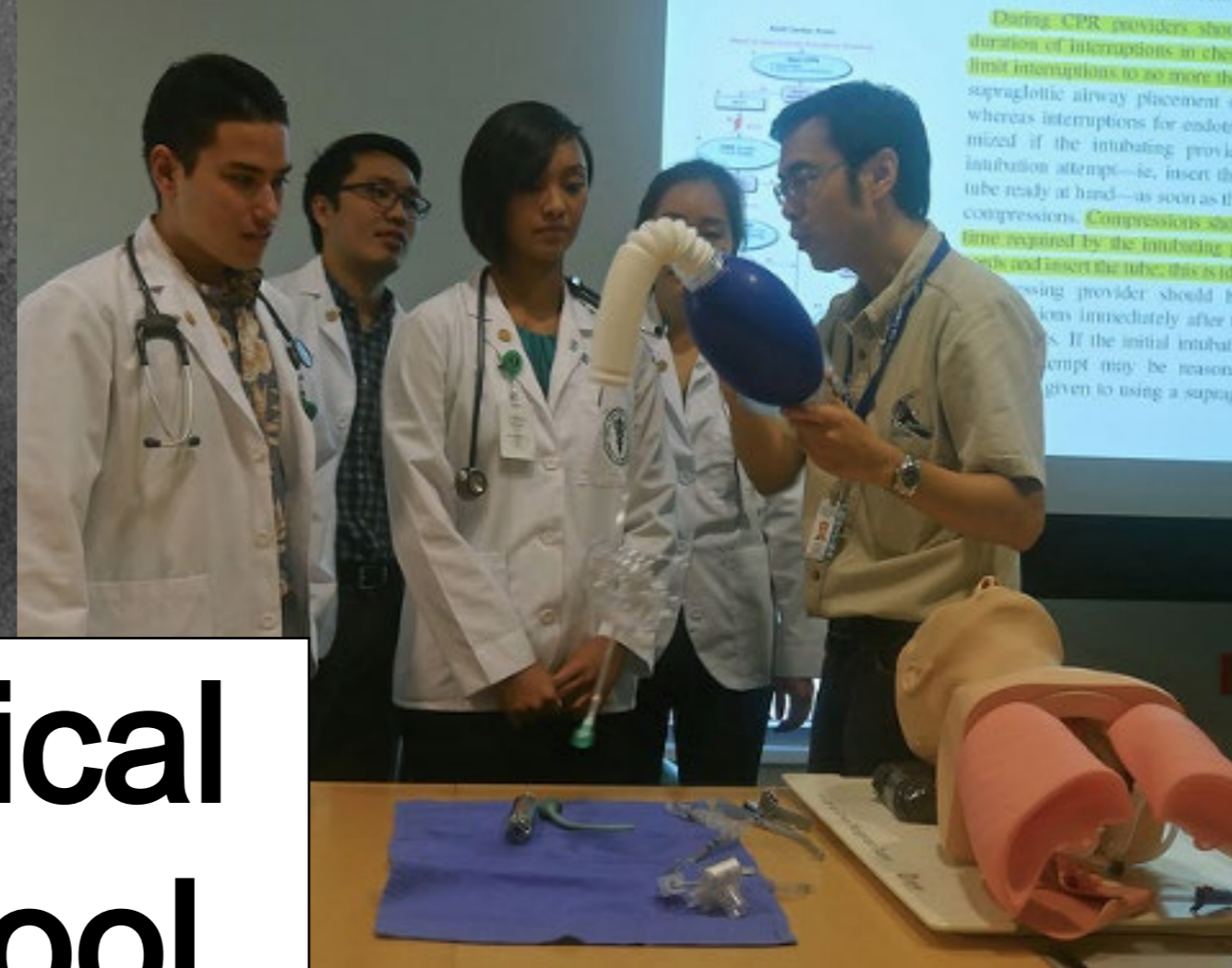
Group 4: Create cause -effect chart of species impact

Whole class: Genetic bottleneck simulation

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.



Medical School Model



PBL
PjBL

o
r

PBL

???

Experiencing Subject Matter from an Expert's Perspective



Oversimplification and dogmatism are the twin enemies of creative thought.

Experiencing Subject Matter from an Expert's Perspective



Premature closure on a productive question can destroy imagination.

Experiencing Subject Matter from an Expert's Perspective



Concepts are worthless unless they lead children to new explorations.

Elements of Problem -Based Learning



III-Structured Problems

III-Structured Problems

**...cannot be defined with a
high degree of
completeness**

The Center

of Expert Activity

**...cannot be solved with a
high degree of certainty
(King & Kitchener, 1994)**



III-Structured Problems

Educational Benefits

Content Knowledge
Process Knowledge
Multiple Solution Paths
Choice and Decision Making
Evaluative Thinking
Metacognition



A Story

Realistic Fiction
Mystery





Stories
Data with a Soul

Dr. Brene Brown

STORIES



are *more memorable* than other forms of narrative
(Graesser et al. [2002](#)) even capturing the attention of
children who are typically distractible (Willingham [2004](#))

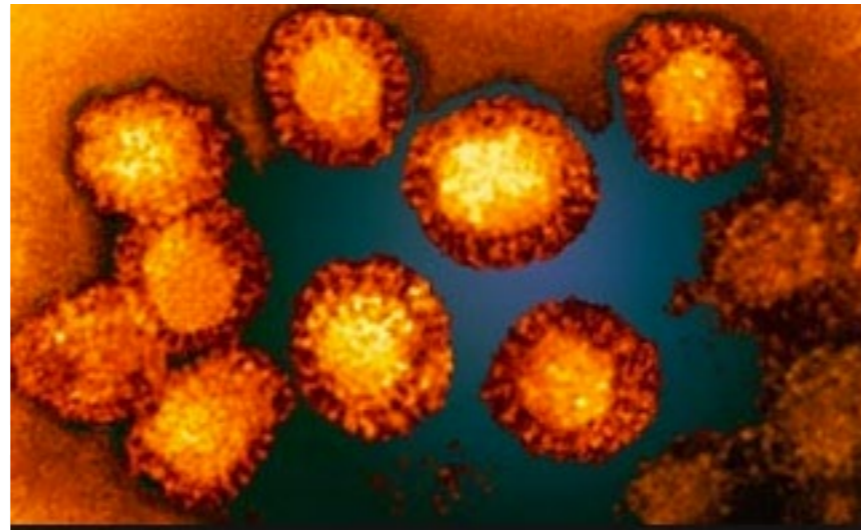
Growth



Is Rooted in
the Story


Critical thinking only occurs in the face of perceived need

Recognizing the **NEED** to think precedes all thinking



OFFICE OF THE CHIEF OF POLICE
Bureau of Identification

\$20.00 REWARD



WONG YUK (Chinese)

Wong Yuk, (Chinese) age 27 years; height 5 feet 7½ inches; weight 165 pounds; large scar over right ear in hair; front tooth upper jaw broken.

This man was ordered deported and placed on board Steamship Chiyo Maru for that purpose.

He escaped from the steamer just prior to sailing Saturday, August 31, 1912.

If located arrest and wire me, or U. S. Immigration Authorities, or notify any Southern Pacific Agent.

Dated, San Francisco, September 2, 1912. D. A. WHITE, Chief of Police



NEW YORK JOURNAL AND ADVERTISER

AMERICAN WOMEN UNITE TO SAVE MISS CISNEROS.



Mrs. Julia Ward Howe, Mrs. Frances Hodgson Burnett, Clara Barton, Mrs. Jefferson Davis, Mrs. John A. Logan, AND ALSO Mrs. John Sherman, Mrs. W. C. Whitney, Mrs. John G. Carlisle, Mrs. Mark A. Hanna and Mrs. E. D. E. N. Southworth. Led by Mrs. Sherman, Wife of the Secretary of State. Never Before Has There Been Witnessed Such an

YOU are the **STORYTELLER**



They are the
PROTAGONIST



Hi, guys. It's Pete calling. We just finished the count of released BFFs in the field for this week, and I wanted you to know that I noticed something kind of weird. Two out of seven seemed to be limping, and another one had a scabbed-over ear like it had been cut or something. Otherwise they didn't seem all that sick. No lumps or anything...but still, I'm worried. They were suffering, and it was keeping them from getting around well. I thought you'd want to know.

I gotta go. I have to get all these burrs off of me before I meet with Dr. Ladner this afternoon.

An Immersion
in
Significant Content
through
an Expert's Point of
View



A
“Stakeholder”

An
Apprentice



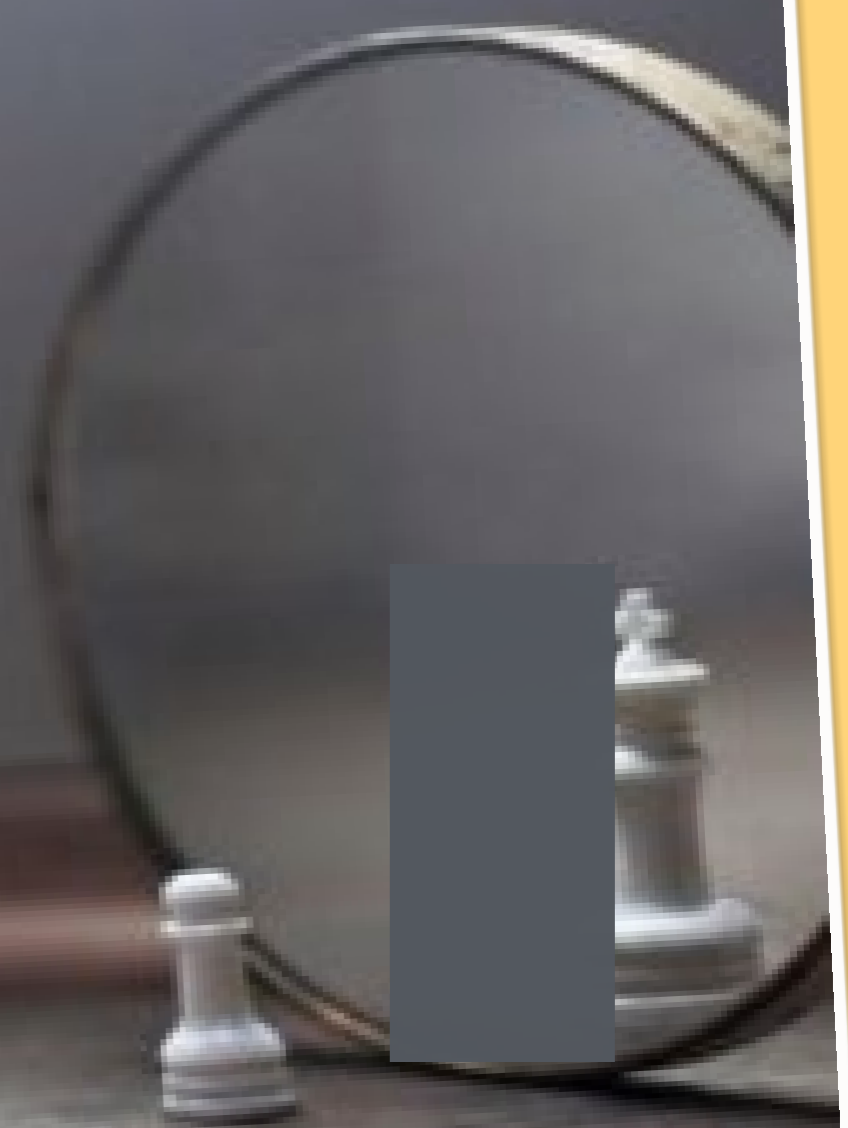
Apprenticeship



Apprenticeship

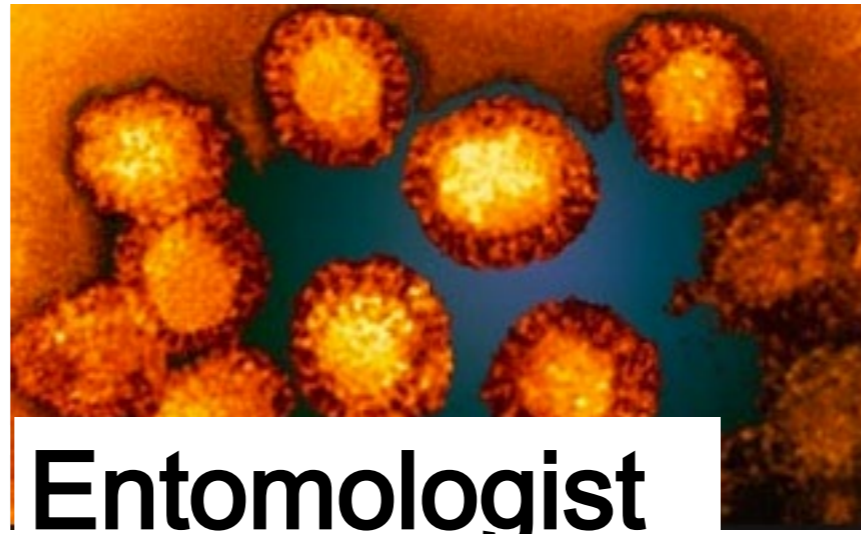
The Purpose of an APPERNTICESHIP is to provide both
hands-on training and theoretical instruction
so that an interested person can learn
the *full range of skills and information*
behind a *highly skilled occupation*.
by participating in an apprenticeship
he can learn the
subtilities
of the craft from an expert and
can begin
his own practice
under close observation.

In the best curriculum a
student acts as a
hero
willing
to become an
unknown self





Vet



Entomologist



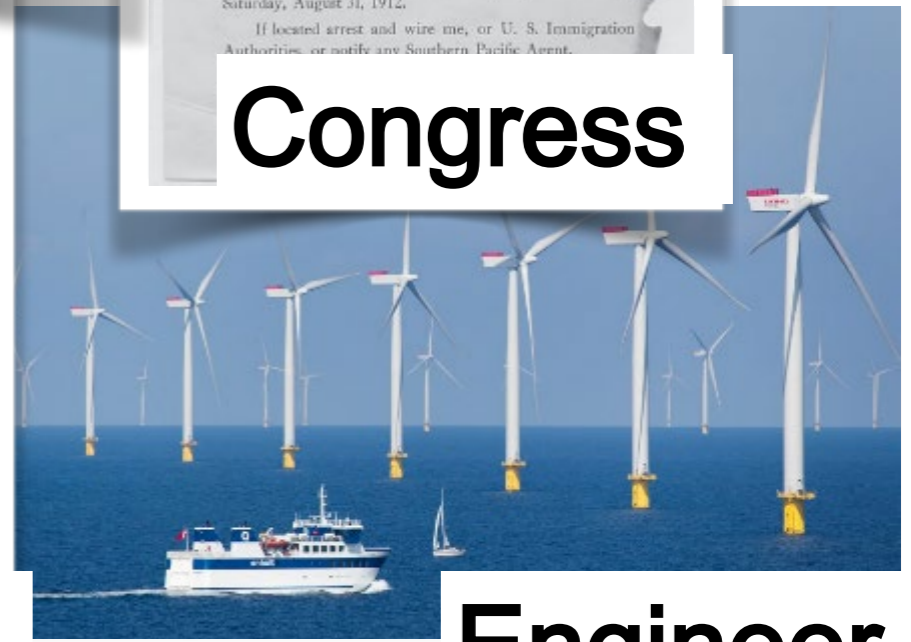
Congress



Task Force



Biologist



Engineer



Town Elder



Journalist

Complex emotional feelings like interest, inspiration, indignation or compassion ...pertain ...to



abstract inferences, interpretations and ideas.

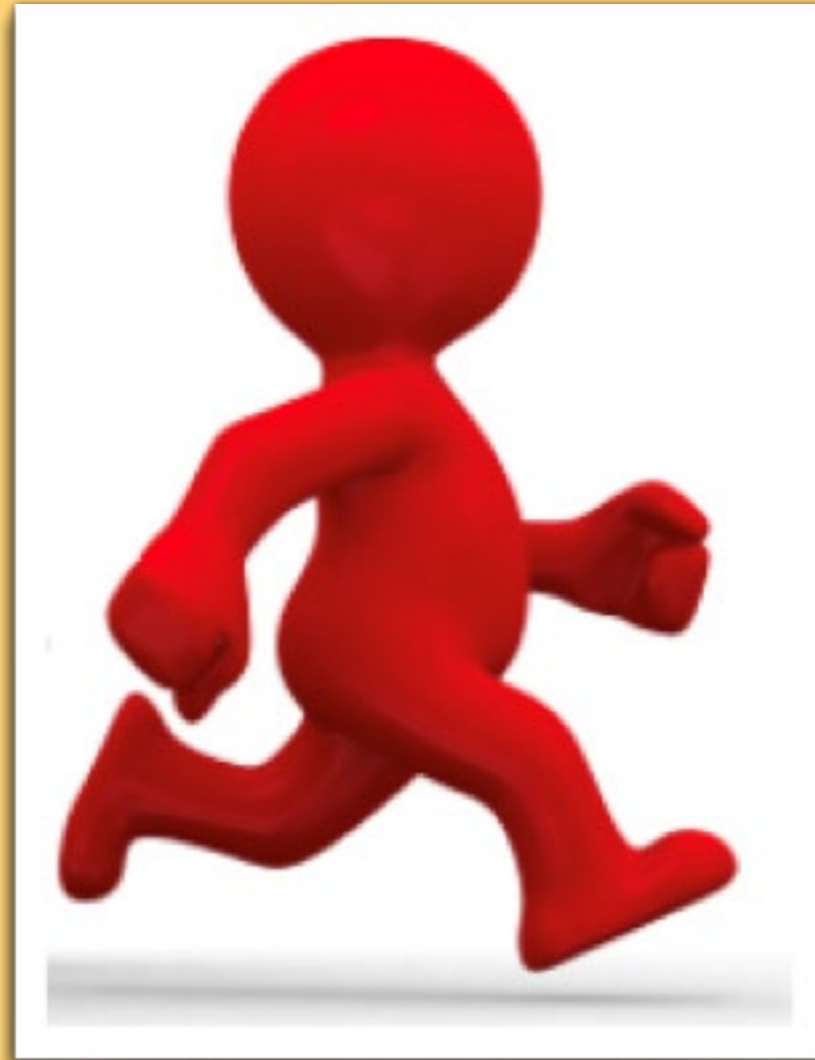
Emotions, Learning, and the Brain
Mary Helen Immordino-Yang



“It is ... neurobiologically impossible to think deeply about things that you don’t care about.”

Emotions, Learning, and the Brain Mary Helen Immordino-Yang

NOT a Simulation



**All Students Joining in a
Single Perspective**

Community of Practice



...a group of people who share a concern or a passion for something they do, and learn how to do it better as they interact regularly.

(Wenger & Trainers, 2011)

Metacognitive Coach

Cruise Director

Organize Activities

Manage Level of Difficulty

Keep the Story Alive



Socrates

Helping Students Think

Building Intellectual

Toolbox

Encouraging Independence



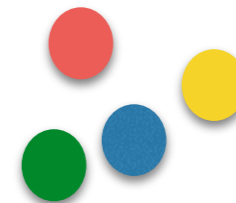
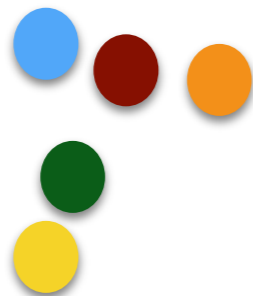
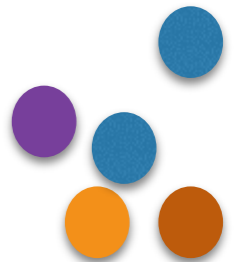
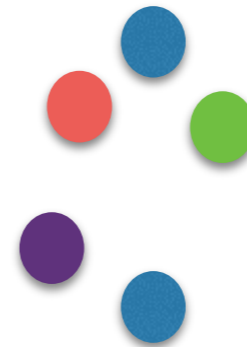
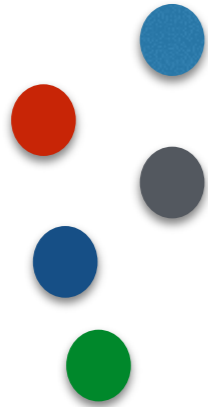
Flexible Grouping

<u>Know</u>	<u>Learning Issues</u>	<u>Action</u>



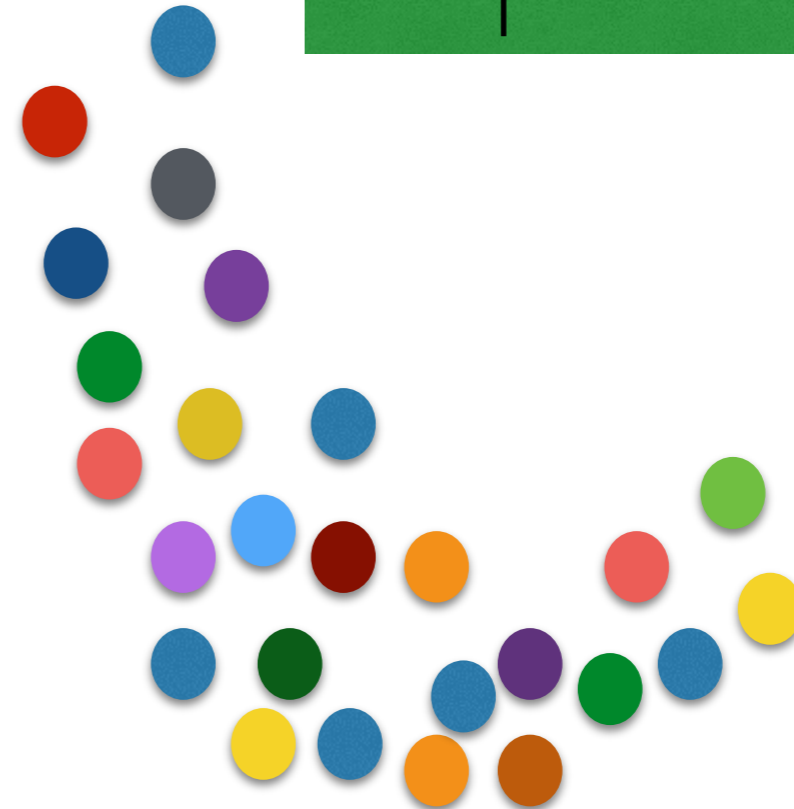
Flexible Grouping

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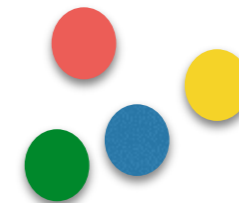
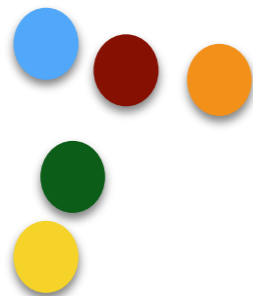
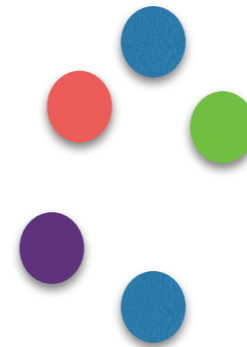
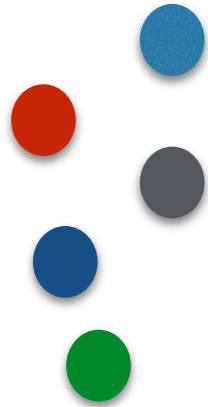


Flexible Grouping

<u>Know</u>	<u>Learning Issues</u>	<u>Action</u>



Flexible Grouping



<u>Know</u>	<u>Learning Issues</u>	<u>Action</u>

Flexible Grouping

<u>Know</u>	<u>Learning Issues</u>	<u>Action</u>



Help them Think about Thinking

**Which
questions
should we
consider first?**



A PLAN



3.

CURRICULUM MODELS

provide the opportunity for sustained
investigation/evolution of an idea

LESSONS

establish the level of
rigor.

Model



Lesson

**The Crucial
Relationship
Between
Curriculum Model
and
Lesson**

METACOGNITION

Core Content

Problem Solving

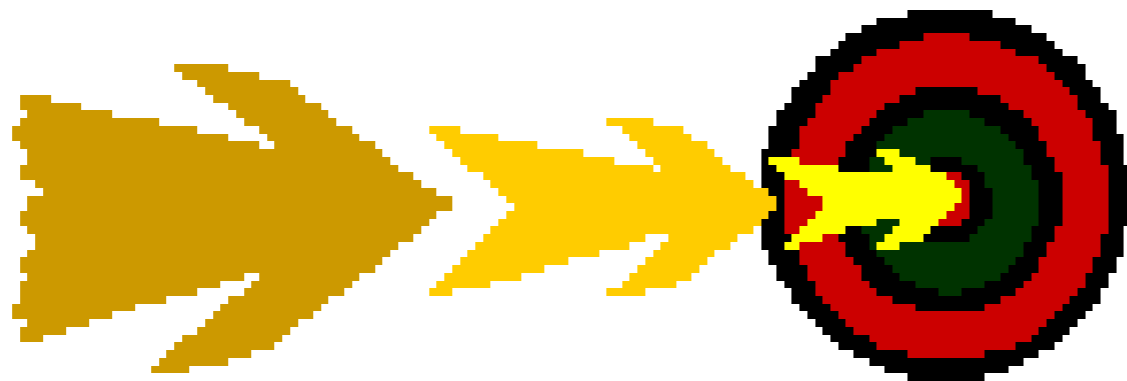
Conceptual Reasoning

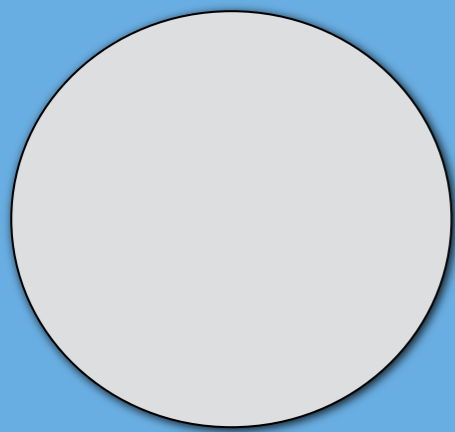
Research

Dispositions

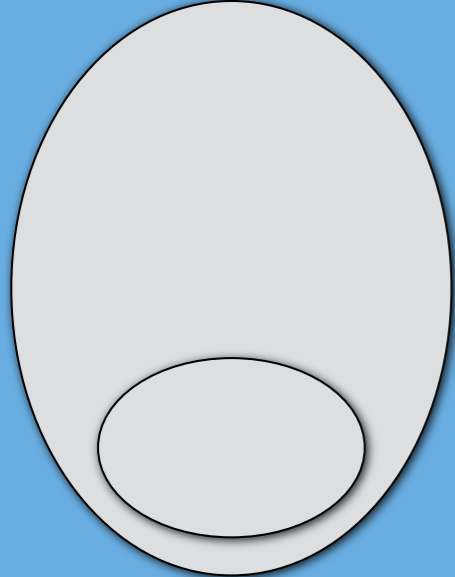
Thinking Skills

Ethics



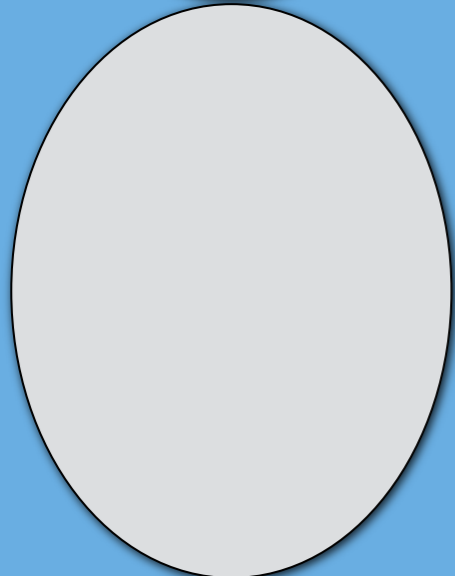


Engagement

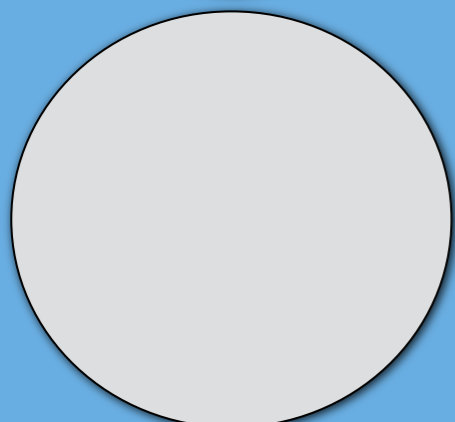


Inquiry and Investigation

Problem Definition



Problem Resolution



Problem Debriefing

The Flow

of

the

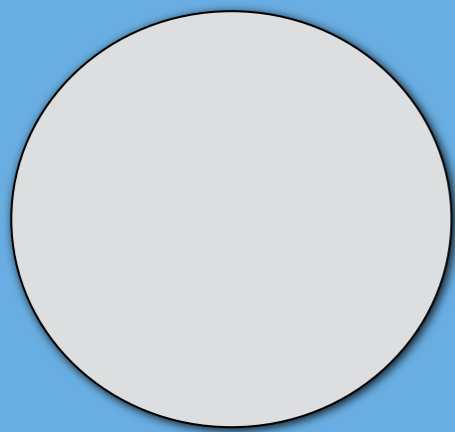
Problem

Concepts: Systems

Content: Biology and Habitats

Primary Resources

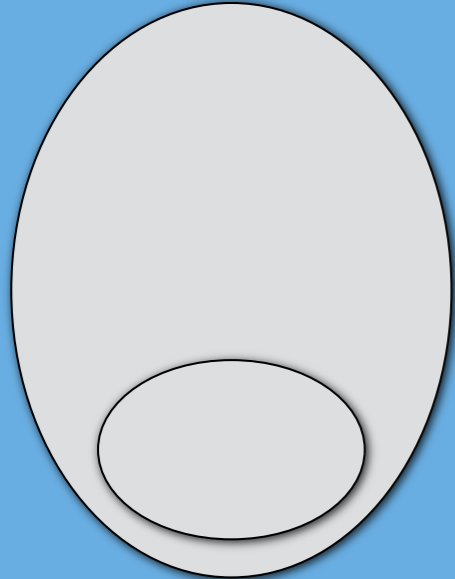
Process: Perspective Taking



Engagement

Problem Solving

Research Strategies



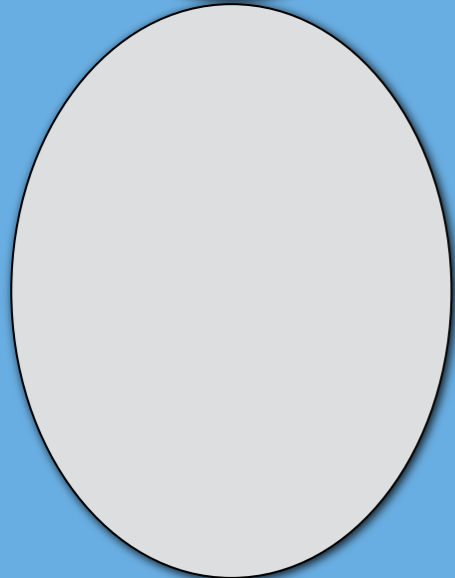
Inquiry and Investigation

Questioning

Socratic Seminars

Problem Definition

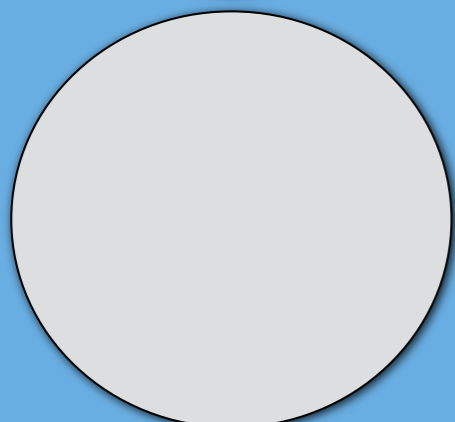
Communication



Problem Resolution

Organizing Information

Collaboration/Consensus



Problem Debriefing

Concepts: Systems

Content: Biology and Habitats

Primary Resources

Process: Perspective Taking

Embedded Instruction:

☒ Teacher Reference

Sample Learning Issues Board

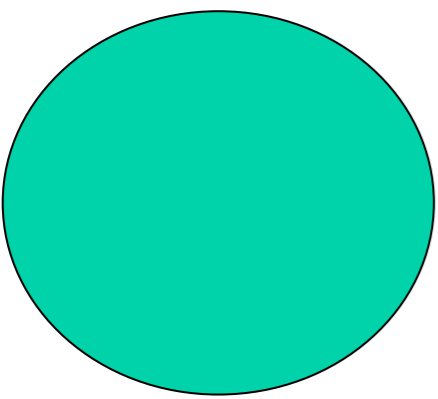
Hunches: Efforts to save the ferret have not been very successful, and we need to change our tactics. We might lose our funding. Maybe something is wrong with the ferret. It must be hard to reintroduce black-footed ferrets into a suitable habitat.

What We Know	Learning Issues	Plan of Action
<ul style="list-style-type: none"> We are members of the Black-Footed Ferret Recovery Reintroduction Team. Progress on reintroduction of black-footed ferrets is not moving quickly enough. Some believe efforts are too expensive and too labor-intensive. The media is covering our efforts. We need to be proactive by anticipating problems and by creating a model of a feasible habitat suitable for ferrets and other inhabitants. Fort Collins, Colorado, is the test site. Black-footed ferrets are fragile. We need to take into account the "human climate." We are required to present a feasible model to the Project Oversight Committee in about two weeks. 	<ul style="list-style-type: none"> What is the Black-Footed Ferret Recovery Reintroduction Team (BFFRRT)? Why are we reintroducing ferrets? What is so special about the black-footed ferret? What is a genetic bottleneck? What did the media say? How much does it cost to reintroduce black-footed ferrets? Why were we brought together as a team? Could we just go somewhere else? What makes a suitable habitat for this kind of ferret? What challenges have occurred during past reintroduction efforts? What can we learn from less successful attempts? Do we need to change anything at the test site in order to be successful? Do we need to do anything to accommodate the fragility of black-footed ferrets? What does "human climate" mean? What makes a good model? 	<ul style="list-style-type: none"> Research the goals and objectives of the BFFRRT. Research past ferret reintroduction efforts to see if there are things we can learn. Look at maps of the Fort Collins area. Read the newspaper article. Ask a biologist why the black-footed ferret is "fragile." Find information about the black-footed ferret habitat.

Information for Research

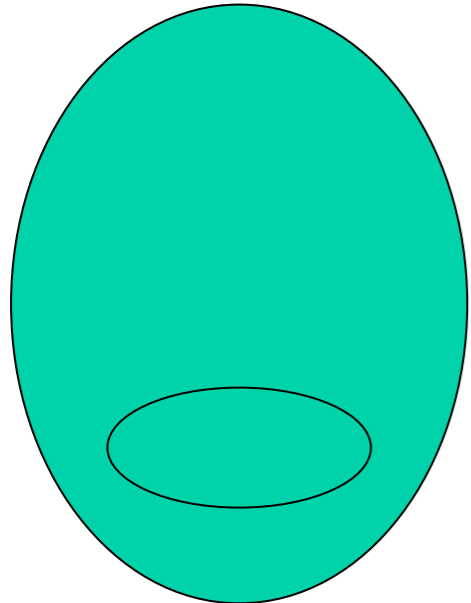
What learning processes, thinking skills, habits of mind do I want my apprentices to learn?

What concepts?
 What advanced readings?
 What complex ideas?
 What interdisciplinary connections?



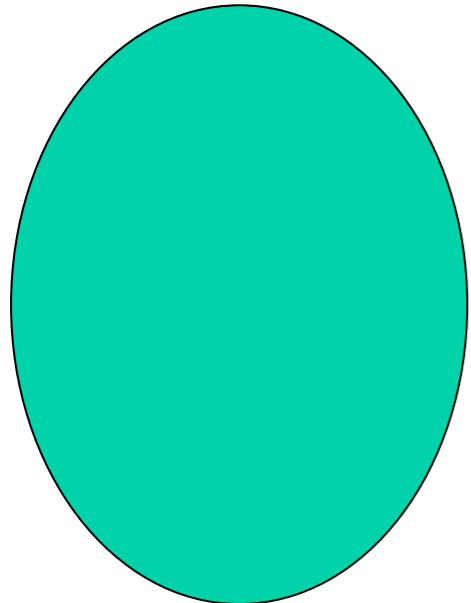
Problem Engagement

1. The BFFRRT



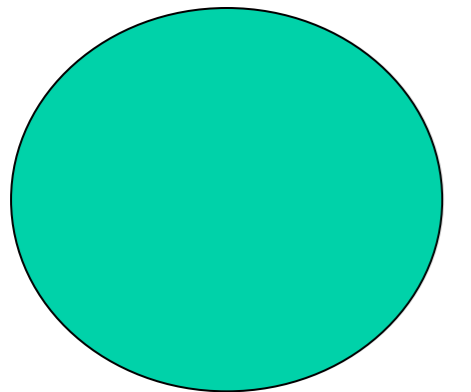
Inquiry and Investigation

- 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



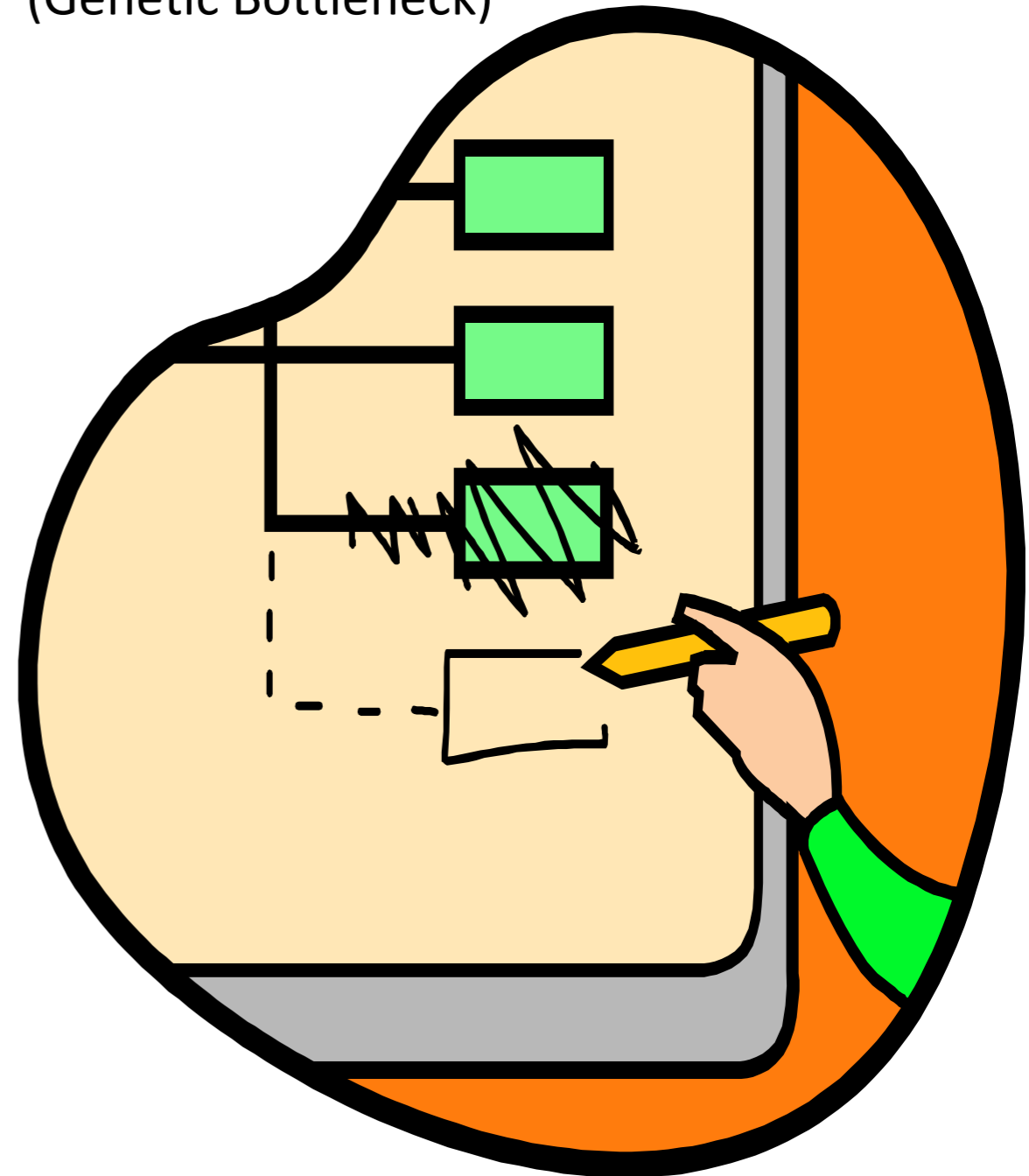
Debriefing

1. Review/Reflect/Extend

Laying out the Plan...

(Ferret Math)

(Genetic Bottleneck)



**is ONLY PARTIALLY
Appropriate for
Gifted Students**

**(the same is true of other
curriculum
models in gifted education)**

Conceptual Reasoning

CONCEPTS:

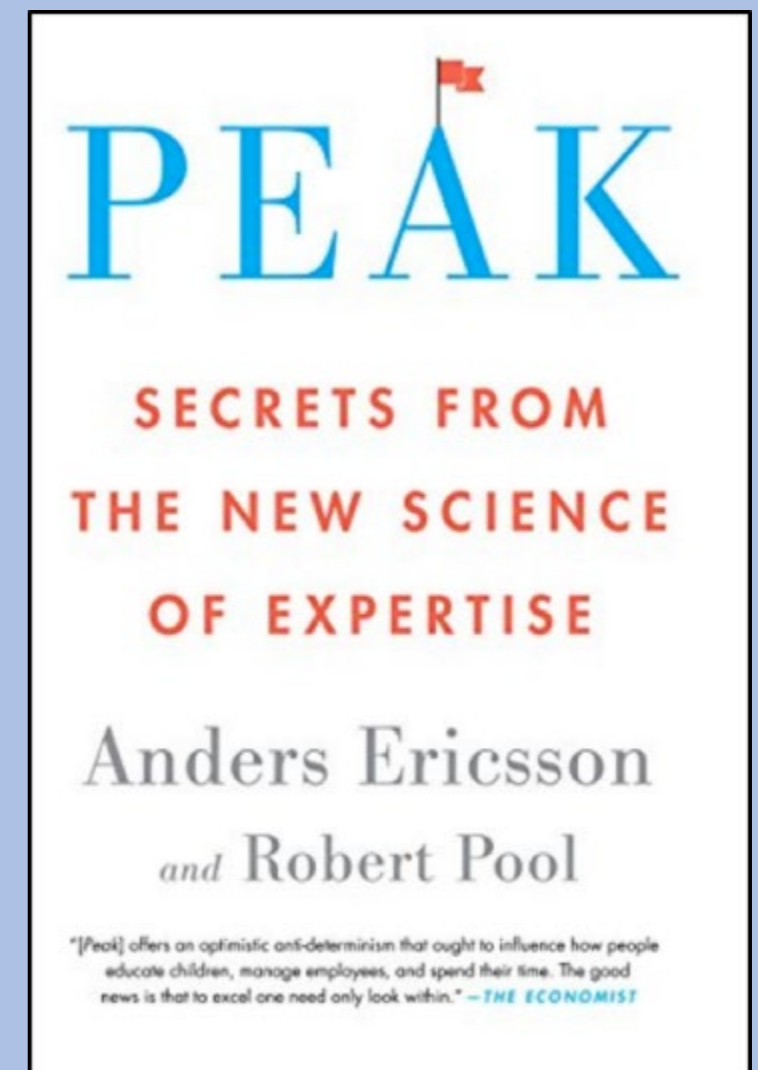
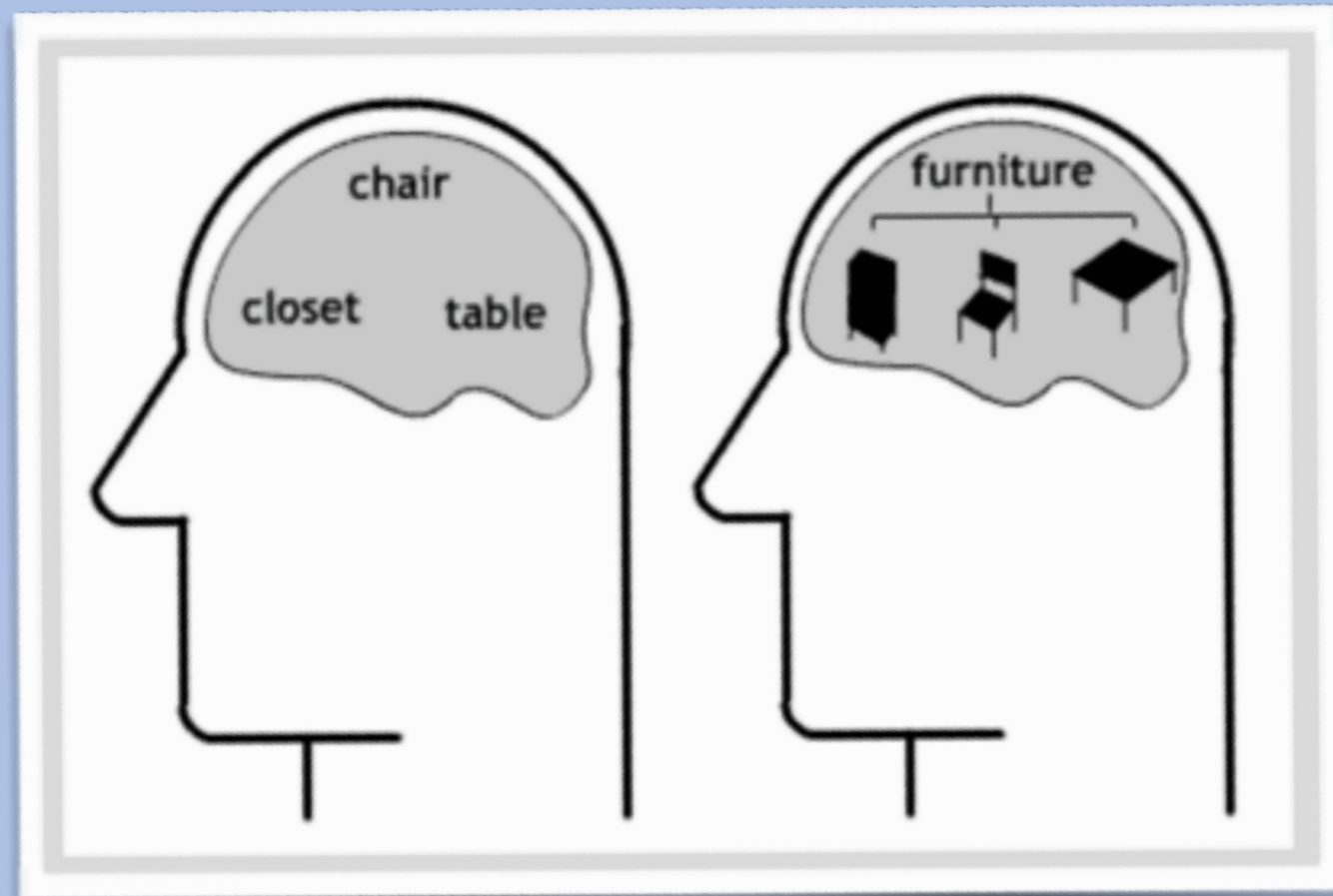
MORE than just a **BIG**
IDEA



CONCEPTUAL REASONING

**“WHAT SETS EXPERTS PERFORMERS
APART FROM EVERYONE ELSE IS THE
QUALITY AND QUANTITY OF THEIR
MENTAL REPRESENTATIONS. ...**

**THESE REPRESENTATIONS ALLOW THEM
TO MAKE FASTER, MORE ACCURATE
DECISIONS AND RESPOND MORE QUICKLY
AND EFFECTIVELY IN A GIVEN SITUATION.**



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

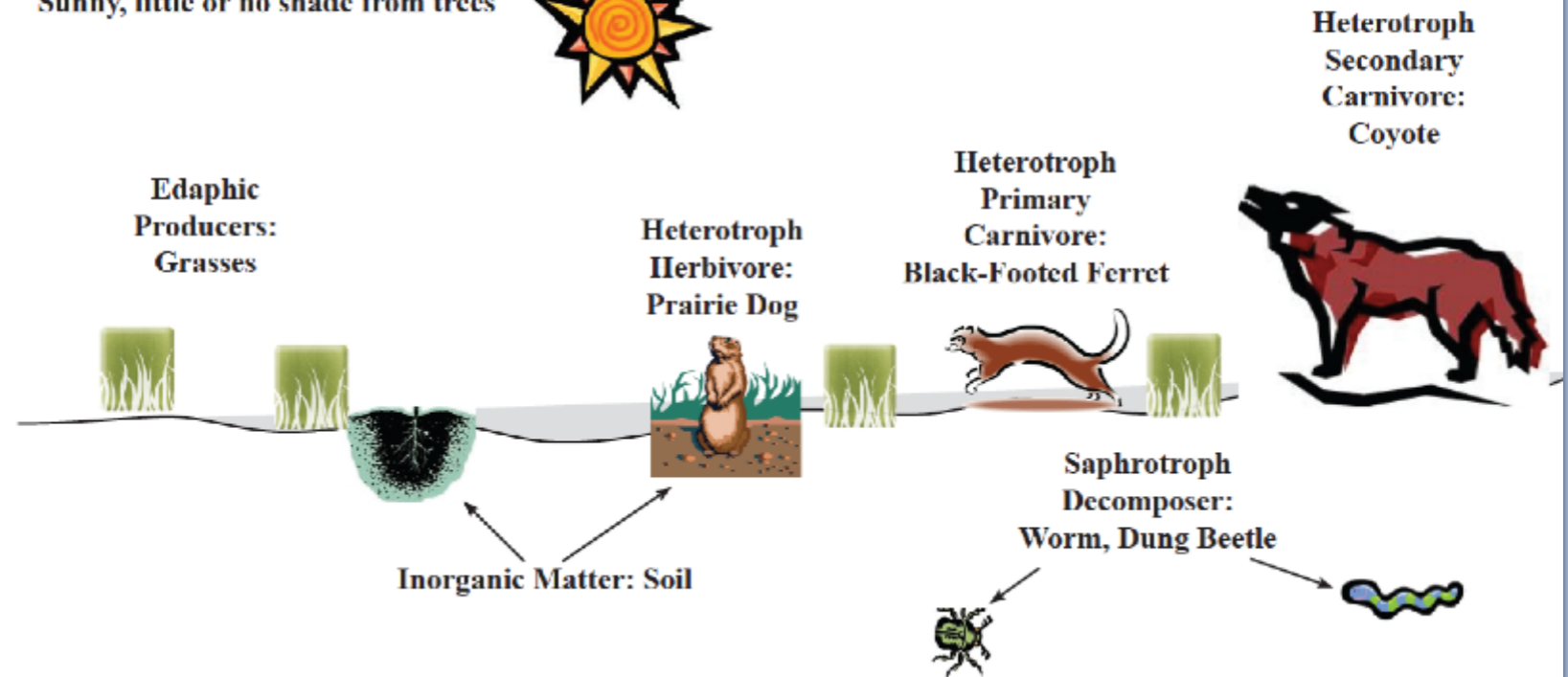
Elements of a system must all function correctly, or the system will break down



Sample Prairie Ecosystem Template

Directions: Complete the template 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 predator and one food source. Label elements using scientific terminology.

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



Key Questions:

- ◆ *What seem to be absolutely essential ecosystem elements for the ferret?*
- ◆ *What are absolutely essential ecosystem elements for the prairie dog?*
- ◆ *What would happen if **all** of the prairie dogs disappeared?*
- ◆ *What would happen if **half** of the prairie dogs disappeared?*
- ◆ *What would happen if there was a lengthy drought? A sudden monsoon?*
- ◆ *Based on our discussion, what does balance do for an ecosystem? What happens when one part of a system is out of balance?*

Key Questions for Part 3:

- ◆ *What threats could disrupt an ongoing supply of food for the ferrets?*
- ◆ *What do the prairie dogs need to have in the environment in order to thrive?*
- ◆ *What are the environmental or natural threats? Human threats?*
- ◆ *Which threats have multiple impacts? What does that tell you about the relative power of the threats?*
- ◆ *Which threats, if any, are interrelated? Which, if any, create new or additional threats?*
- ◆ *What is the relationship between a threat and an input to a system?*

Investigation

Varying Modes of Information Gathering

Primary Resources

Books

Internet

Video

Interviews with Experts

Published Research

Secondary Resources

Media/Journalists

Biased and Incorrect Resources

Writing

Summarizing/ Writing

Department of the Interior
US Fish and Wildlife Service

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.

Inquiry

Critical thinking!

Problem Log

Determining Causes

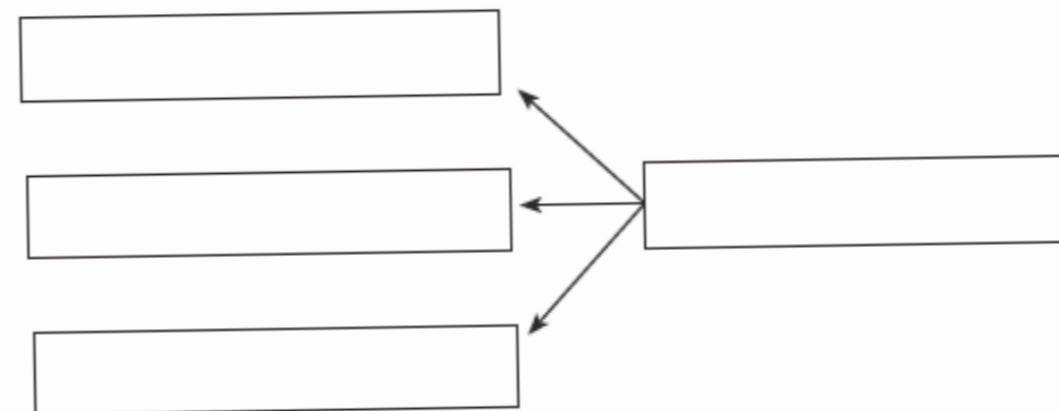
Directions: Use this space to record the cause-effect relationships among the Critical Components from the Black-Footed Ferrit Habitat Chart. Use arrows to connect each fact to its prior cause. If there is a Critical Component that you think is important, but not directly connected, included in the chart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

Distant Causes

Prior Causes

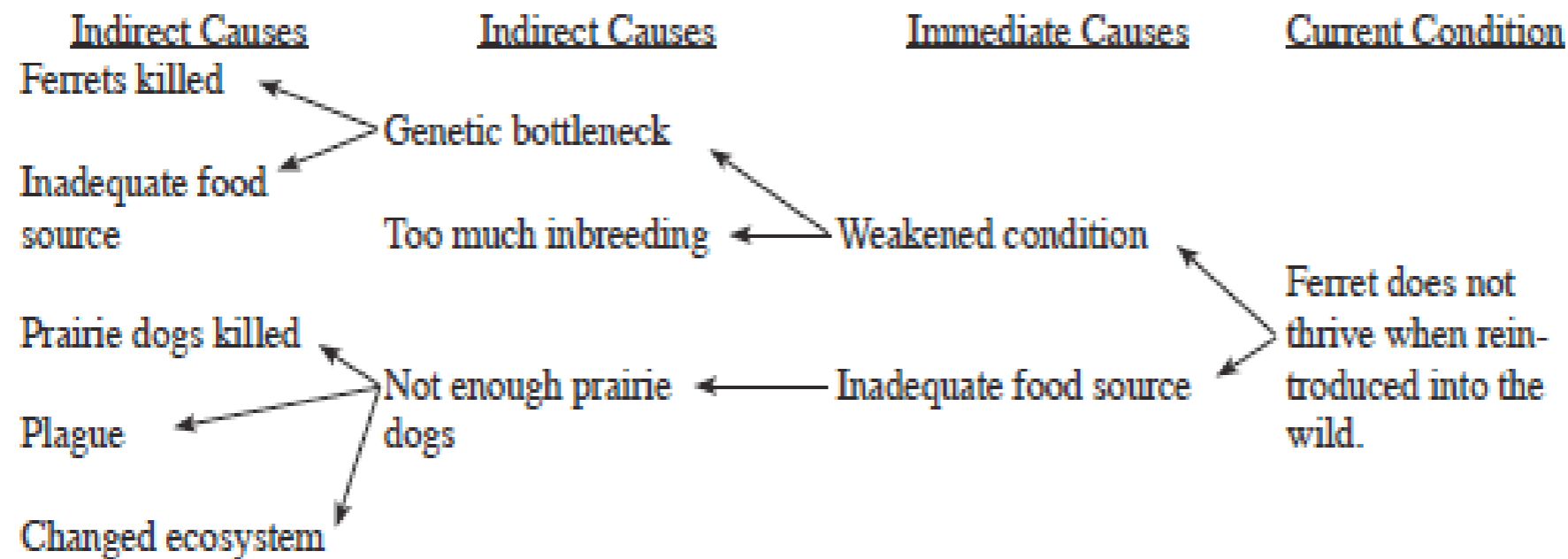
Immediate Causes

Current Situation



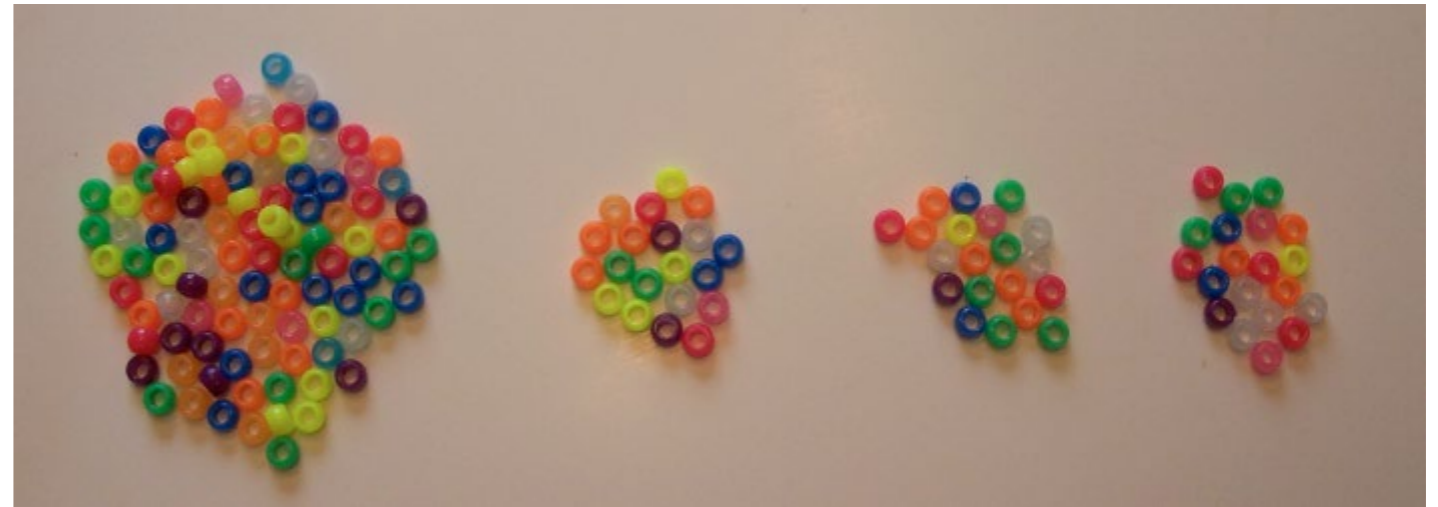
Critical Thinking!

Example: Why did the prairie dog population decline in the 1980s?



Result:

Genetic Bottleneck Demonstration



Teacher Reference

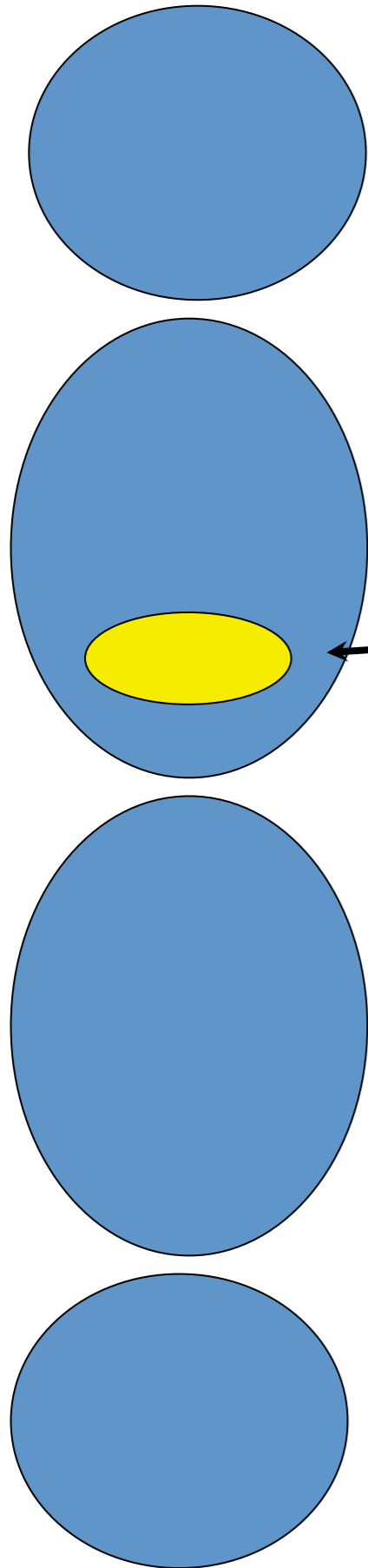
The Genetic Bottleneck Data Sample #1

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.

Trait/ Color	'Typical' Variation				Bottleneck			Rebuilding
	Generation 1	Generation 2	Generation 3	Generation 4	Generation 5	Generation 6	Generation 7	Generation 8
1. Dark Blue	10	10	12	12	4	2	1	0
2. Light Blue	10	8	11	16	0	0	0	0
3. Orange	10	7	8	8	1	1	0	0
4. Red	10	3	4	3	2	3	1	1
5. White	10	7	7	9	5	5	8	11
6. Light Green	10	14	9	4	1	0	0	0
7. Dark Green	10	14	17	14	3	6	8	22
8. Purple	10	18	15	14	1	1	1	3
9. Yellow	10	12	9	11	1	2	1	3
10. Black	10	7	8	9	2	0	0	0

Teacher
Reference

Problem Definition



Problem Definition

Issue(s)

Constraint(s)

FORMAT:

How Can We

in a Way That

How can we create a model ecosystem for BFFs in a way that allows ranchers to earn a living?

How can we save the BFF in a way that does not require human involvement?

How can we save the BFF and prairie dogs in a way that is safe for humans?

ISSUES

How can we create a habitat for the Black Footed Ferret

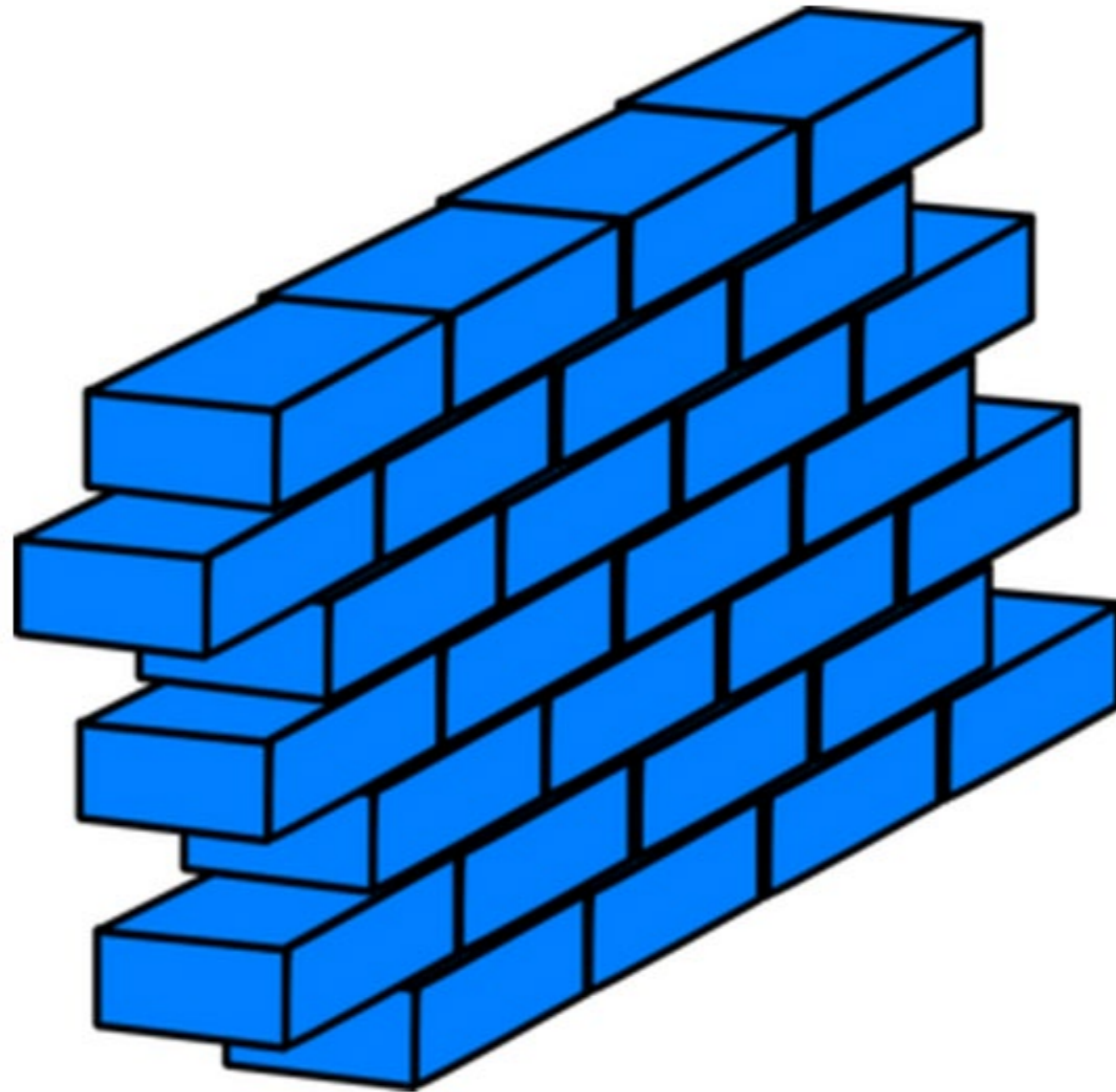
that allows them to thrive independently
and is acceptable to local ranchers.

Constraint

Constraint

Constraint

Creativity



Constraints

Problem Resolution

Criteria-Based Decision Making

Problem Log

Name: _____

Problem Resolution Grid

Problem Definition: _____

PROBLEM RESOLUTION GRID				
<i>Instructions:</i> List the criteria for a good problem solution in the left-hand column. List your options across the top row (only use the number of rows necessary). Next, rate how well each solution option addresses the different criteria using a 3-point scale, in which 1 is <i>Matches Very Well</i> and 3 is <i>Matches Very Poorly</i> . Total the ratings for each solution option.				
Solution Options →				
Solution Criteria ↓				

Criteria-Based Decision Making

Sample Problem Resolution Grid

Problem Definition: How can we create a self-sustaining model black-footed ferret habitat in a way that minimizes contact with home owners and helps ranchers?

PROBLEM RESOLUTION GRID				
<i>Instructions:</i> List the criteria for a good problem solution in the left-hand column. List your options across the top row (only use the number of rows necessary). Next, rate how well each solution option addresses the different criteria using a 3-point scale, in which 1 is <i>Matches Very Well</i> and 3 is <i>Matches Very Poorly</i> . Total the ratings for each solution option.				
Solution Options → Solution Criteria ↓	Provide Protected Area for Prairie Dogs	Vaccinate Black-Footed Ferrets	Relocate Prairie Dogs to National Park Area	
Self-Sustaining Model	1	2	1	

Culminating Activities

REQUIREMENTS

⊙ To complete this project, we want:

- Prairie dogs 
- Grasses 
- Water 
- Open land/No human interference 

⊙ The ranchers want:

- Land
- No prairie dogs
- Grass

⊙ The general population want:

- Land
- To be able to work on the land



SOLUTIONS TO THREATS

- Put BFF in places that has lots of PD and areas with healthy grass.
 - Put in places that has non-cold winters.
- Past studies have shown BFF cant make antibodies to diseases so have to make sure no humans come into or around the area
 - Also people made vaccinations for the plague made by scientists at the NWHC
- Should either be put in Montana, South Dakota, Arizona, Colorado, Utah, Chihuahua, and Mexico because many already live there.



Present their Model

Newspaper Editorial

From: Mitchell Lodner, Fish and Wildlife (mlodner@email.us.fwl.gov)
 Subject: Reintroduction Effort—Letter to Editor for The Coloradoan
 Date:
 To: Black-Footed Ferret Recovery Reintroduction Team (bffrt@email.us.fwl.gov)

I have recently learned about your efforts to preserve the black-footed ferret, and I understand you are working on creating a reintroduction site model based on the Fort

Problem Debriefing

Key Questions:

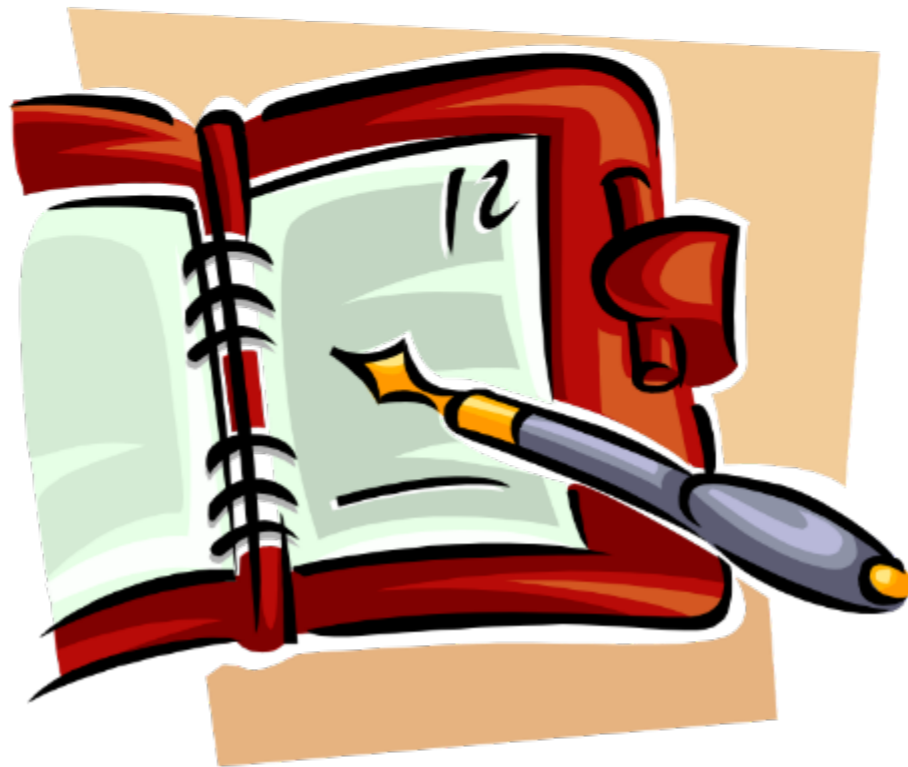
- ◆ *How were the issues raised in the town council meeting the same or different from the issues we discussed?*
- ◆ *Why didn't some of their issues emerge in our discussion? How do you think the differing roles (BFFRRT, town council members) affect the issues each group considers important?*
- ◆ *What did you learn about systems during this unit? What happens when a system malfunctions? What are the different ways in which a system can get out of balance? Why is balance important to a system?*
- ◆ *Are all inputs to a system good for a system? What happens when a negative input enters a system? What about output? Are all outputs positive? What's the relationship between negative input and negative output? How often do you think this rule holds true?*
- ◆ *What about our problem-solving process was surprising to you? What do you think went particularly well? What didn't? What do you think we could do as a class to improve how we collaborate? How we solve problems?*



Assessment

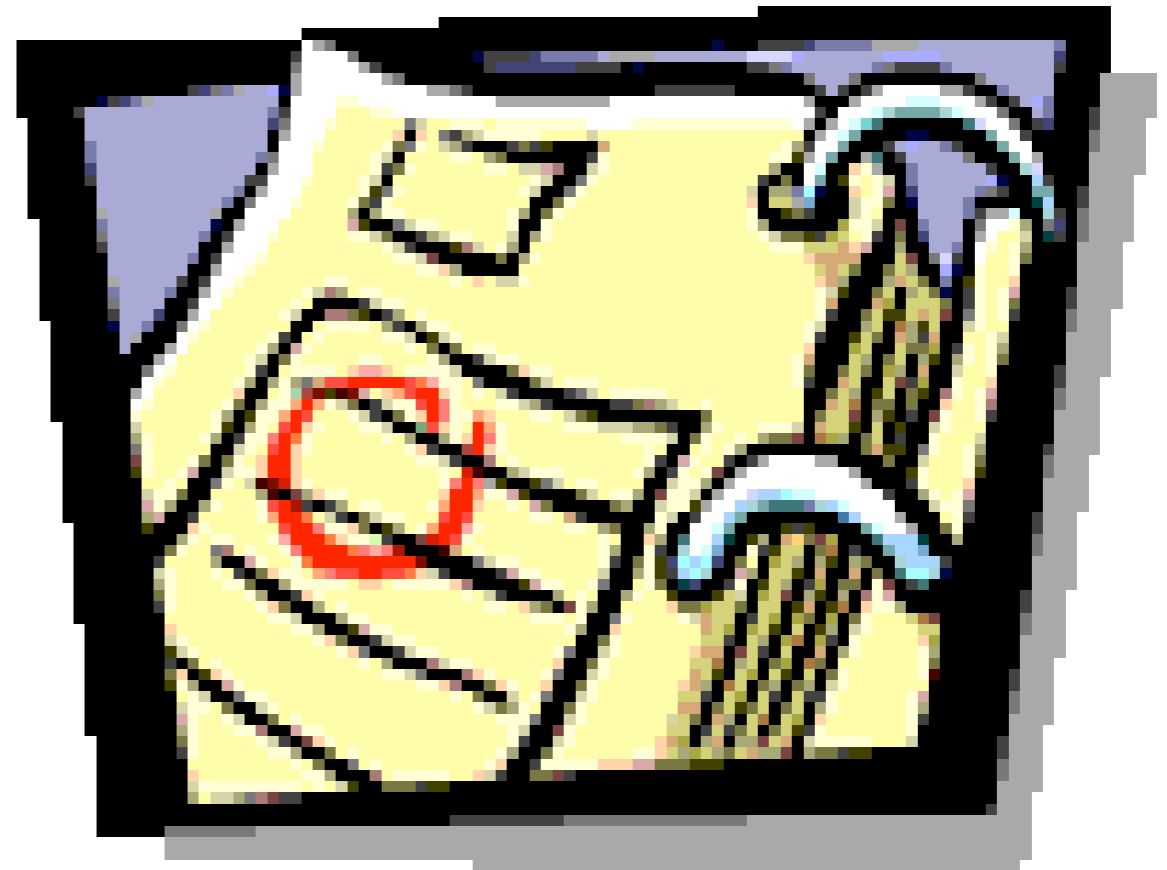
The Problem Log

Classroom Rubrics



Four Components of the Problem Log

- Content
- Process
- Analysis
- Reflection



Presentation Rubric

Name: _____ Date: _____ Self-Rating: _____ Teacher Rating: _____

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

Classroom Engagement Rubric

For each row, check the descriptor that best matches your work or classroom behavior.

	Exemplary	At Standard	In Progress
Quality of Work	<input type="checkbox"/> Produces timely, high-quality work; consciously meets or exceeds standards <input type="checkbox"/> Uses language of discipline frequently and comfortably <input type="checkbox"/> Self-motivated—takes an active, inquisitive role in learning <input type="checkbox"/> Work is original	<input type="checkbox"/> Completes work on time; meets standards established for assignments <input type="checkbox"/> Uses language of discipline when instructed <input type="checkbox"/> Takes responsibility for work and grades <input type="checkbox"/> Work is good replica of teacher’s model	<input type="checkbox"/> Turns in insufficient or incomplete work <input type="checkbox"/> Does not use language of discipline <input type="checkbox"/> Avoids responsibility for work and grades <input type="checkbox"/> Work lacks structure or organization
Class Participation	<input type="checkbox"/> Asks questions to extend the discussion, and clarifies when needed <input type="checkbox"/> Consistently offers point of view, and is open to the views of others <input type="checkbox"/> Uses class time well—uses classroom resources	<input type="checkbox"/> Asks questions to clarify instruction and information when needed <input type="checkbox"/> Answers questions and participates when called upon; respects the views of others <input type="checkbox"/> Uses class time well; stays on task	<input type="checkbox"/> Does not ask questions when needed <input type="checkbox"/> Rarely participates in any way <input type="checkbox"/> Does not use class time well
Group Work/ Behavior	<input type="checkbox"/> Consistently in class—does not fall behind as a result of absences <input type="checkbox"/> Helps others learn <input type="checkbox"/> Takes excellent notes in class <input type="checkbox"/> Takes leadership role in group work	<input type="checkbox"/> Consistently in class; catches up when absent <input type="checkbox"/> Does not disrupt others in class <input type="checkbox"/> Takes useful notes in class <input type="checkbox"/> Is a positive, productive group member	<input type="checkbox"/> Truancies, tardies, and/or absences are a problem; falls behind in work <input type="checkbox"/> Disrupts class <input type="checkbox"/> Takes useless notes or no notes <input type="checkbox"/> Does not contribute to group work; whines and complains; sleeps in class

Reflective Moment: Metacognition

- Scientists tend to be devoted to the areas they study. Why would some degree of passion or devotion be necessary to the recovery of the black-footed ferret?...What happens when passion gets in the way of seeing all perspectives on the problem?

Reflective Moment: Thinking about Systems

- **What are some negative consequences of an unbalanced system? What are some possible consequences of having the system go out of balance.?**

Assessments for Different Lessons

- Problem Engagement
- Inquiry and Investigation
 - Research
 - Genetic Bottleneck
 - Analysis/Synthesis
- Notes Page
- Reflection
- Research Notes
- ‘Top 5 Facts’
- Experimental Design
- Data Chart
- Graphic Organizer

Organic and Authentic



Engaging for ALL

**Differentiated for
the Gifted**

Habitats

Biomes

Metacognitive Reflection

Endangered Species

Advanced Conceptual Reasoning

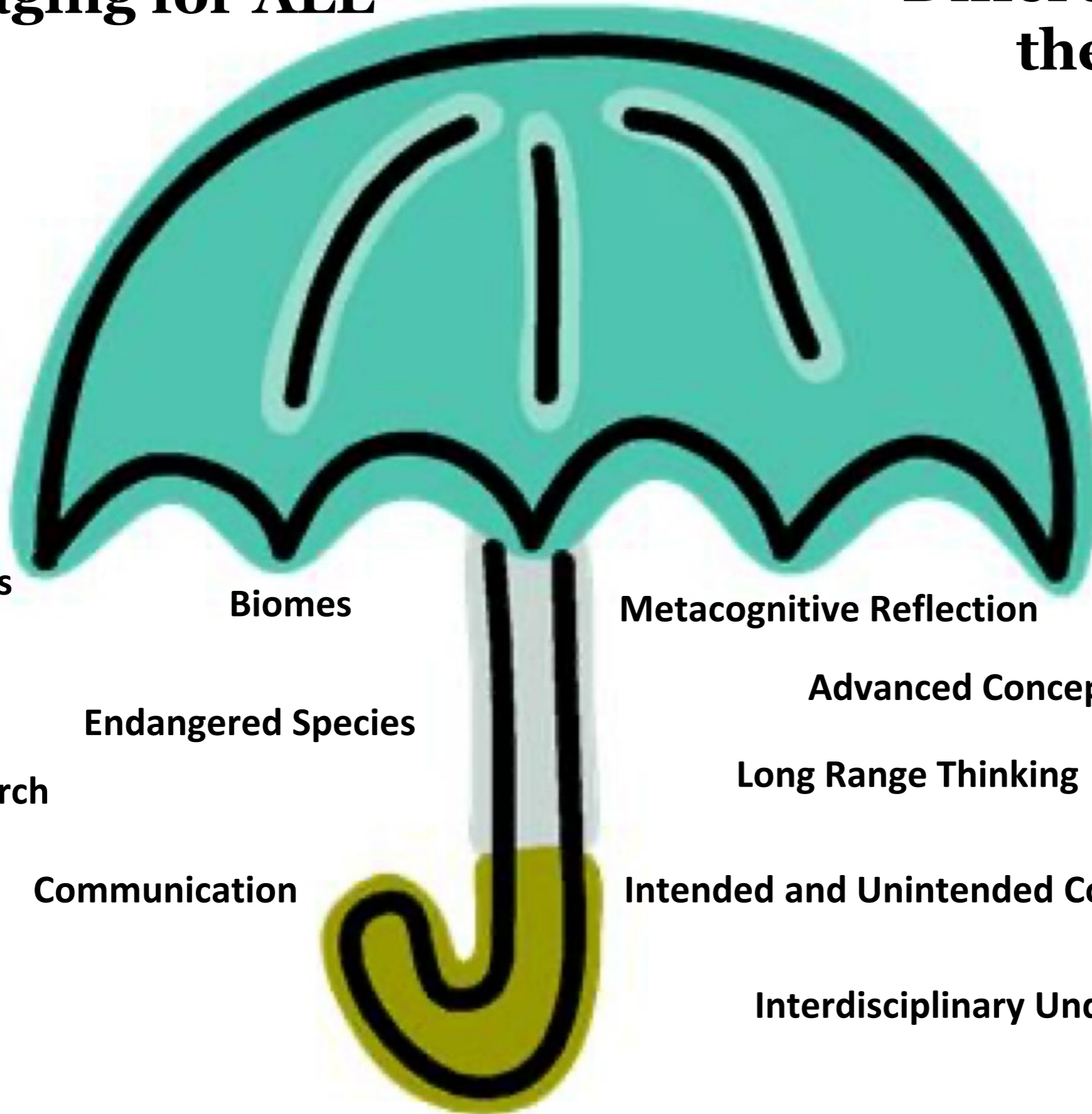
Research

Long Range Thinking

Communication

Intended and Unintended Consequences

Interdisciplinary Understanding



- Short term acquisition significantly lower but levels out over time (MC tests)
- Short term acquisition is no different, or better than, traditional instruction (medical boards, high school studies, clinical reasoning)
- Adding lectures does not increase student achievement in PBL (Van Berkel & Schmidt, 2005)

Gallagher & Stepien, 1997

- 167 Gifted Students
- Traditional or PBL Post-Hole Classroom
- Standardized test Pre- and Post-
- PBL Students Significantly Higher

- 80% of time on task and productive (Visschers-Pleijers, et al., 2004)
- Students in PBL tutorials more engaged than students in other collaborative groups (Wun et al., 2007)
- Increasing self-regulation leads to increased mutual reliance, critical thinking and concept formation (Cooper, et al., 2008)
- Student achievement is higher in effective PBL groups (Van den Hurk, 2006)

“...no sample was found in which the students' attitudes did not favor PBL to some degree.”

Vernon & Blake, 1993, p. 554

- Enjoyment from their learning
- A more meaningful learning environment
- More nurturance
- More and better student-to-student interactions
- Stimulation of a greater breadth of interest in subject matter

- Unprepared: Assignments weren't chunked or clear
- Non-participation: Discussion questions
- Conflicts between students because of unclear expectations
- Students present information that is unrelated to the problem
- Unproductive class discussions
- *Emphasis on research instead of thinking about the problem*

Variable	TI vs. GE			TI vs. AAP			GE vs. AAP		
	Mean	SD	d	Mean	SD	d	Mean	SD	d
End of Grade English	5.55***	1.49	0.79	3.64*	1.72	0.52	-1.91	0.99	0.27
End of Grade Math	3.10	1.45	0.38	1.93	1.68	0.24	-1.17	0.96	0.14
Insights PBL Understanding	1.46*	0.58	0.61	0.90	0.65	0.38	-0.56	0.37	0.23
Insights Science	0.61	0.64	0.25	-0.65	0.74	0.26	-1.26**	0.44	0.51
Insights Social Studies	0.84	0.53	0.36	0.08	0.6	0.03	-0.76*	0.34	0.32
Insights Teacher Ratings	0.02	0.25	0.01	-1.21***	0.28	1.11	1.22***	0.16	1.12

Table 7. Adjusted pairwise mean differences obtained from generalized linear model with classroom as dummy variable

Note: Negative values indicate direction and favor AAP students in all instances. Positive values in TI vs. GE comparison favor TI students.

Using Problem -based Learning to Explore Unseen Academic Potential

<http://docs.lib.purdue.edu/ijpbl/vol7/iss1/9>



Students: Comprehension

- 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.



Students 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.





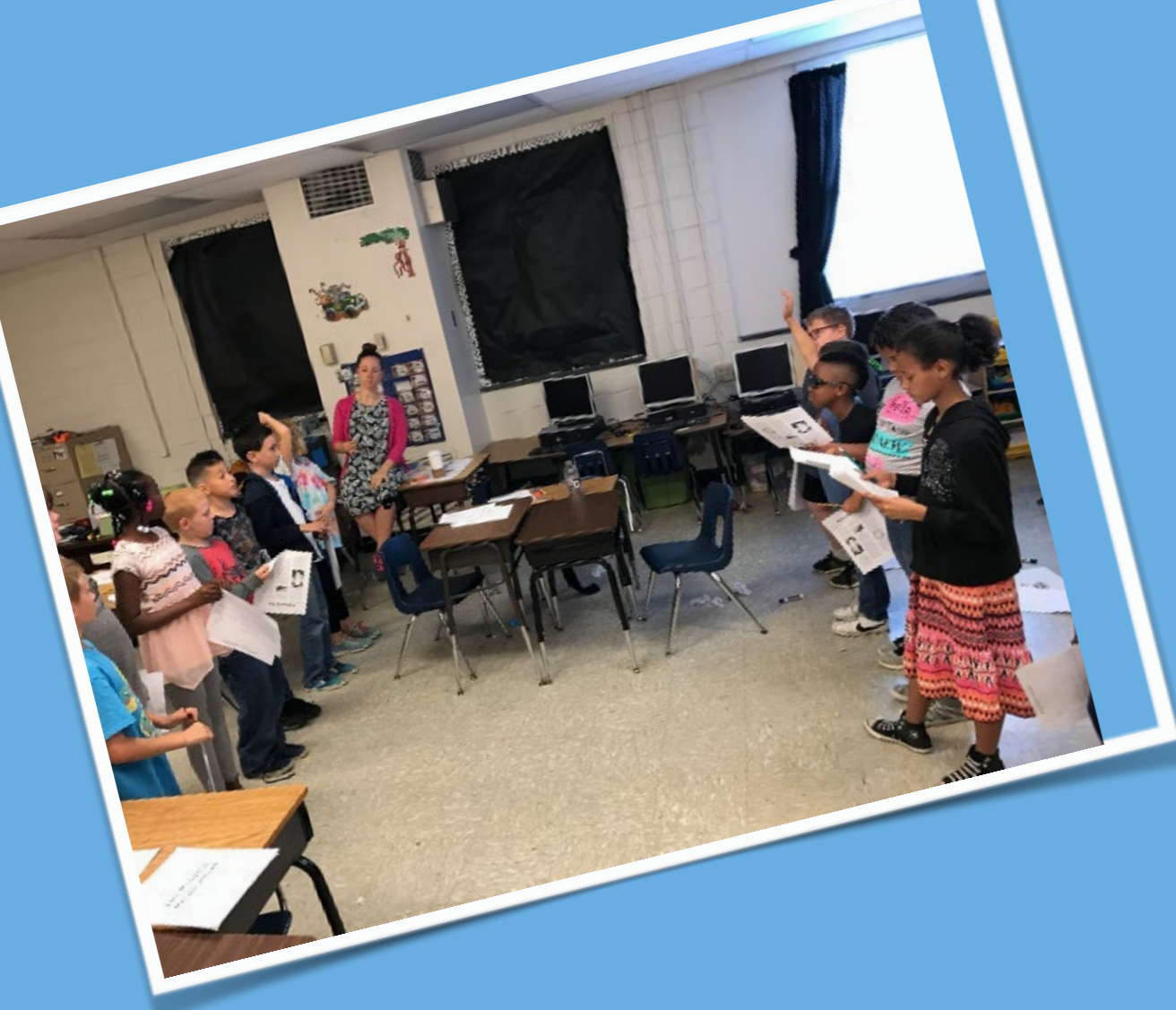
Students: Authentic Learning

- 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.
- 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.

Teachers



- I can't even imagine doing this with out the training. I was scared to death to do this and I had the **training twice**.
- I've been afraid of this unit for a long time, once I did it and saw you **can tie in the content** and you can make it fit because you **don't need to spend that much time** teaching.
- Overall, we were **pretty pleased** with how the unit went, I think even more so after we read our students' comments.



Oh my goodness, I have to tell you the sweetest thing. We have a student in this class ...who tends to have an attitude and struggle academically. He came up to us at the end of today's lesson and asked who's idea it was for us to do this 'whole penguin thing'. When we said I was the one who came across it, he squeezed me with a big hug and just walked away. Thank you so much for letting us pilot this! The kids love it!

4.

**A Foundation for
Culturally
Relevant
Curriculum**

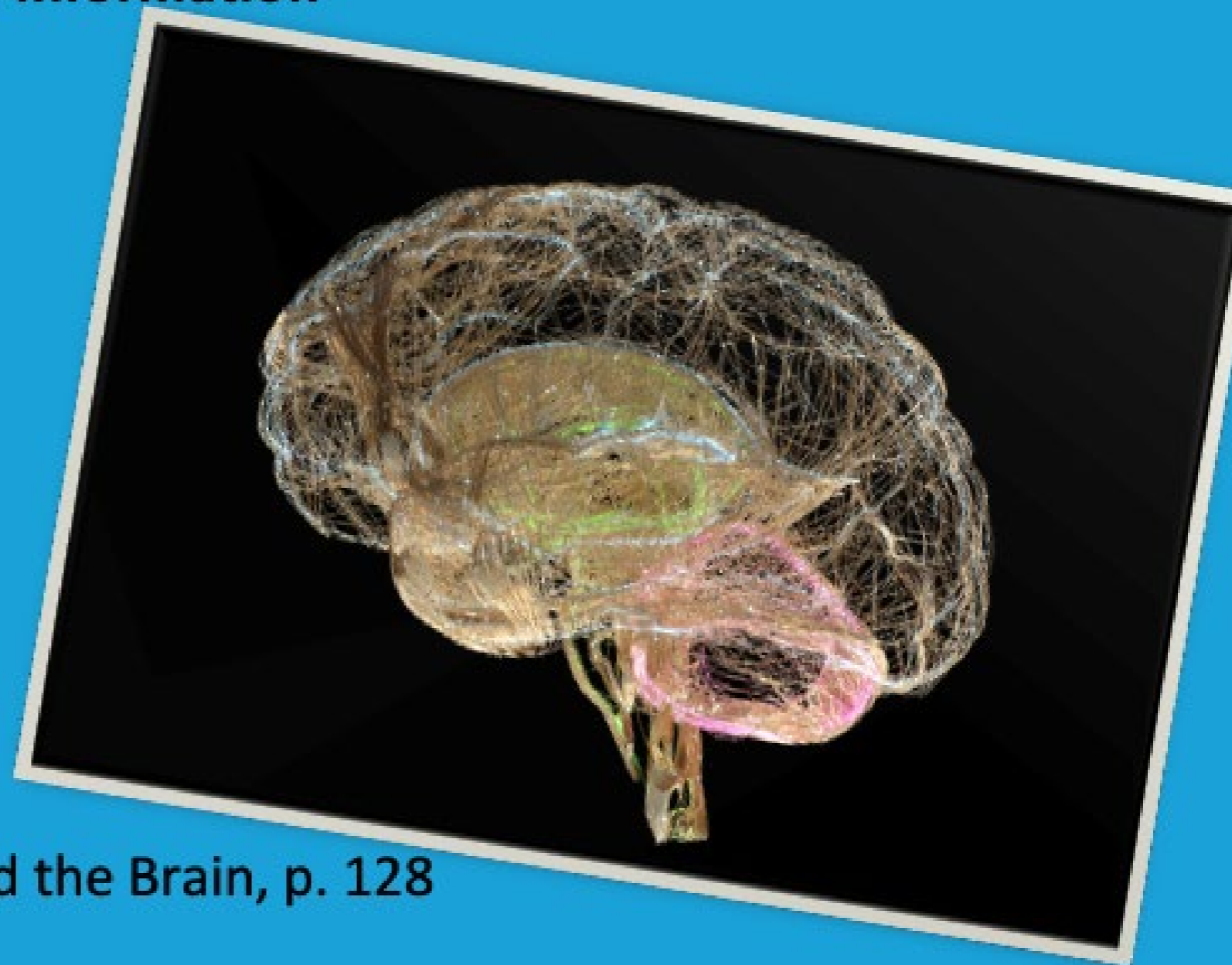
Build Intellectual Capacity

Ignite: Get the brain's attention

Chunk: Make information digestible

Chew: Actively processing new information

Review: Apply new learning



Culturally Responsive teaching and the Brain, p. 128

5.

Musicians and Composers





Musician

The Four Cornerstones: Essential Instructional Skills for Teaching Gifted Students

Questioning

**Sophisticated
Thinking**

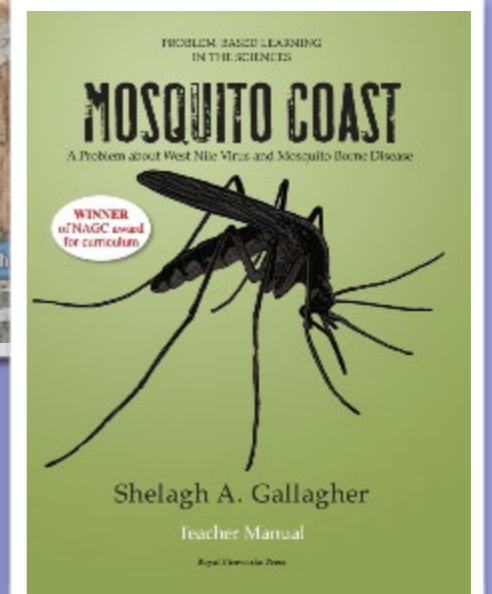
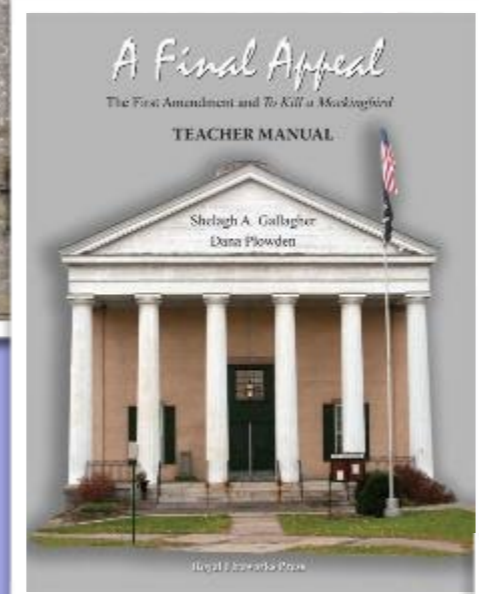
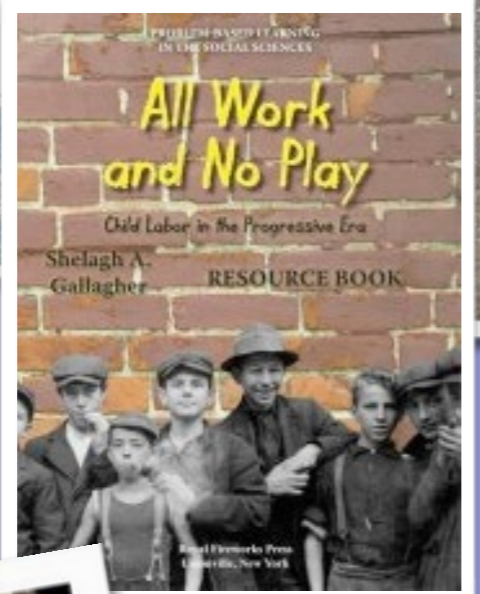
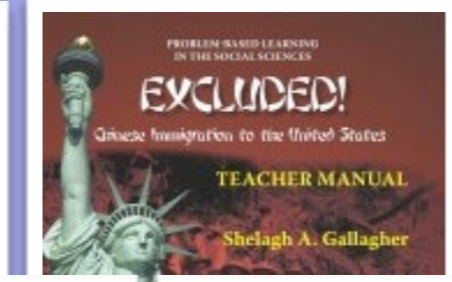
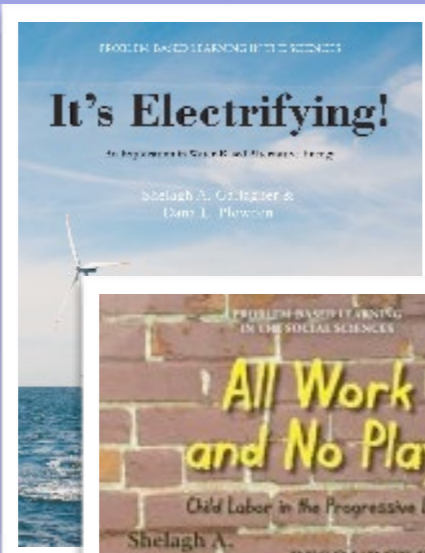
**Conceptual
Reasoning**



**Independent
Learning**



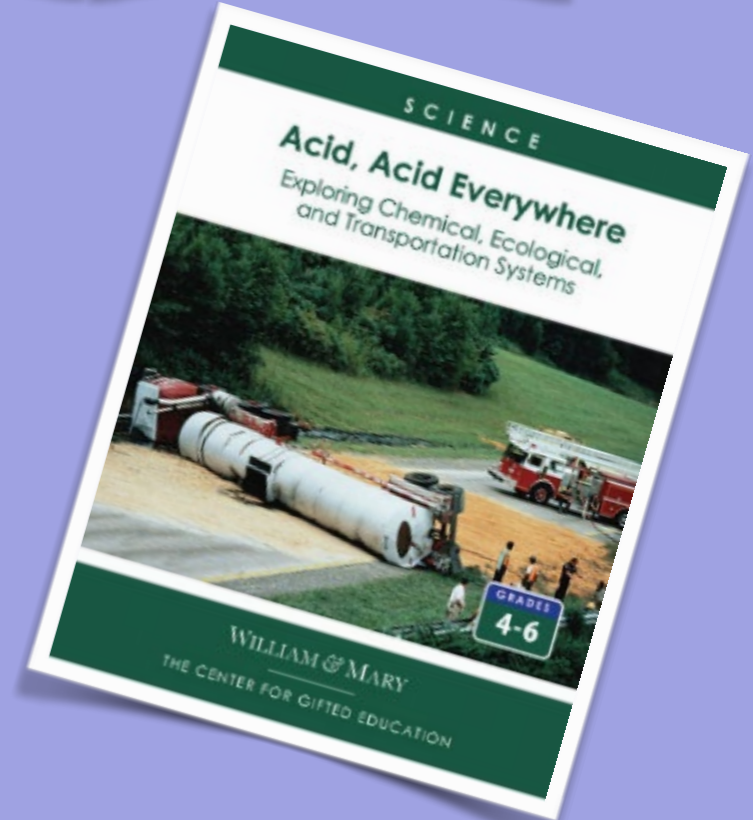
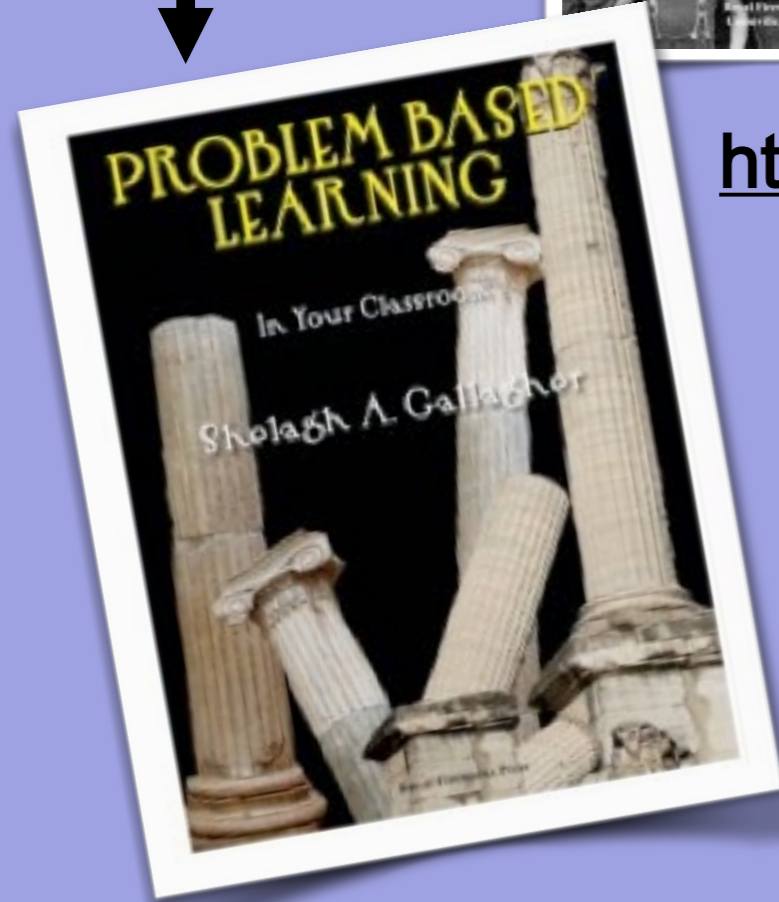
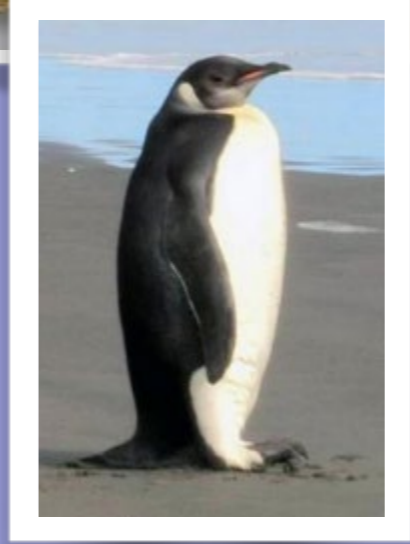




How to Teach PBL



<http://www.rfwp.com>



<https://k12.kendallhunt.com/>



What you have been obliged to discover by yourself leaves a path in your mind which you can use again when the need arises.
G. C. Lichtenberg