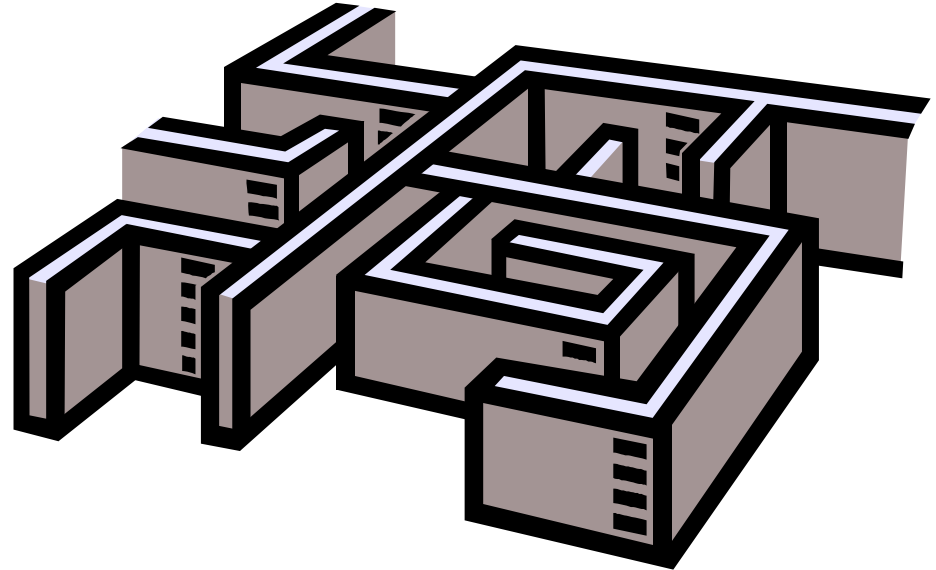


---

# *Problem-Based Learning*

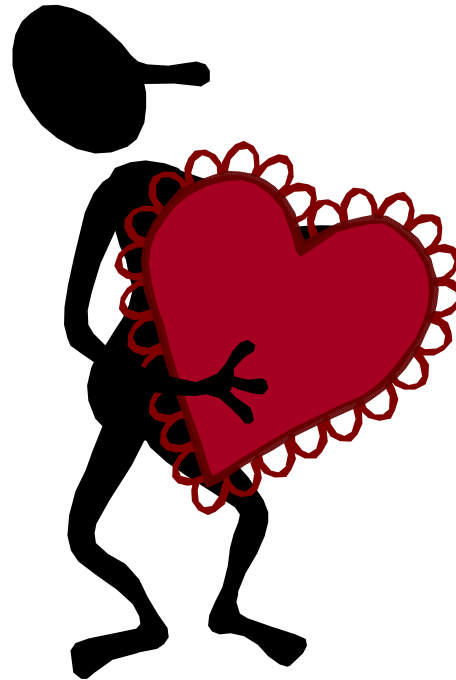
Shelagh A. Gallagher, Ph.D.

[sgallagher5@carolina.rr.com](mailto:sgallagher5@carolina.rr.com)



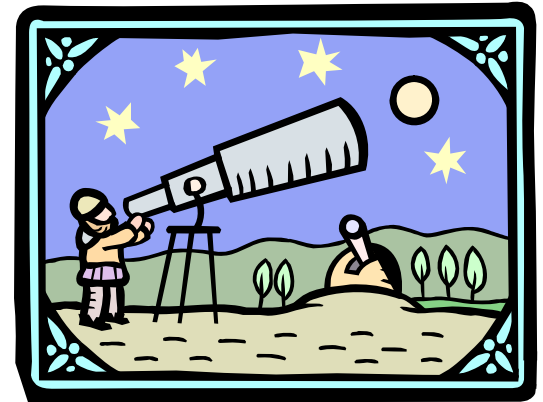
---

# Romance



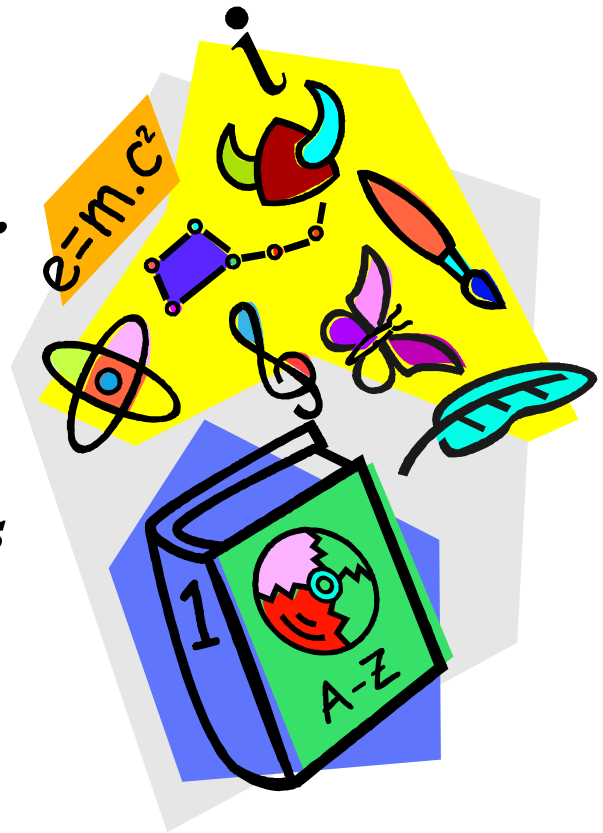
**Once a scientist experiences the exhilaration of discovery and once he has felt the deeper and more expansive feeling...that is the reward for any real advancement of the understanding—then he is hooked and no other life will do.**

**P.D. Medewar**

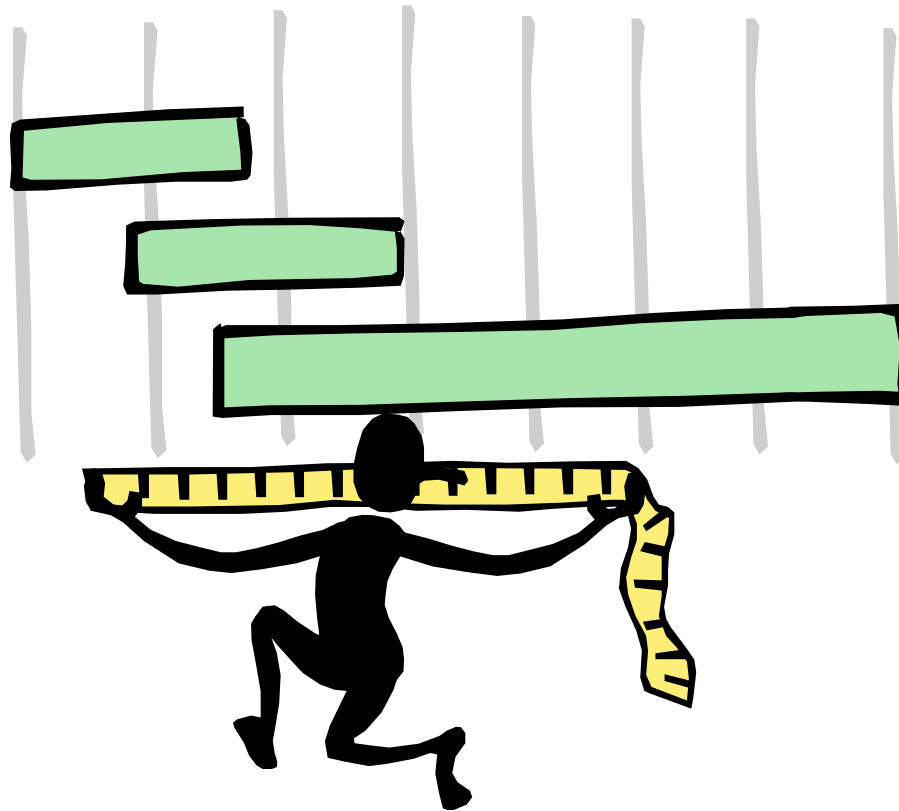


***the historian's passion for manuscripts and sources is ... to see at first hand how an important decision comes to be made. So the last word of the historian is ...a study of the complexity that underlies any generalization that we can make.***

***Butterfield, 1931***



# 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.**

**Entomologist**

**The sensation of writing a book is the sensation of spinning, blinded by love and daring. It is the sensation of a stunt pilot's turning barrel rolls, or an inchworm's blind rearing from a stem in search of a route. At its worst, it feels like alligator wrestling, at the level of the sentence.**

**Write Till You Drop** Annie  
Dillard



---

# Generalization



---

**The most fundamental function of science is to**

**enlarge the interplay between imagination and judgment**

**from a private into a public activity.**



# Requirements for Expertise (and Academic Achievement!)

- Content
  - Factual
  - Conceptual
- Skills
- Metacognition
- Mature Epistemology



# To Make Learning Look like the Real World

- **Use problems at the beginning, not the end**
- **Use ill-structured problems**
- **Relate all learning to the problem**
- **Make students apprentices**
- **Give students responsibility for problem definition and plan of action**
- **Have student defend their resolution using criteria which are meaningful to the discipline.**

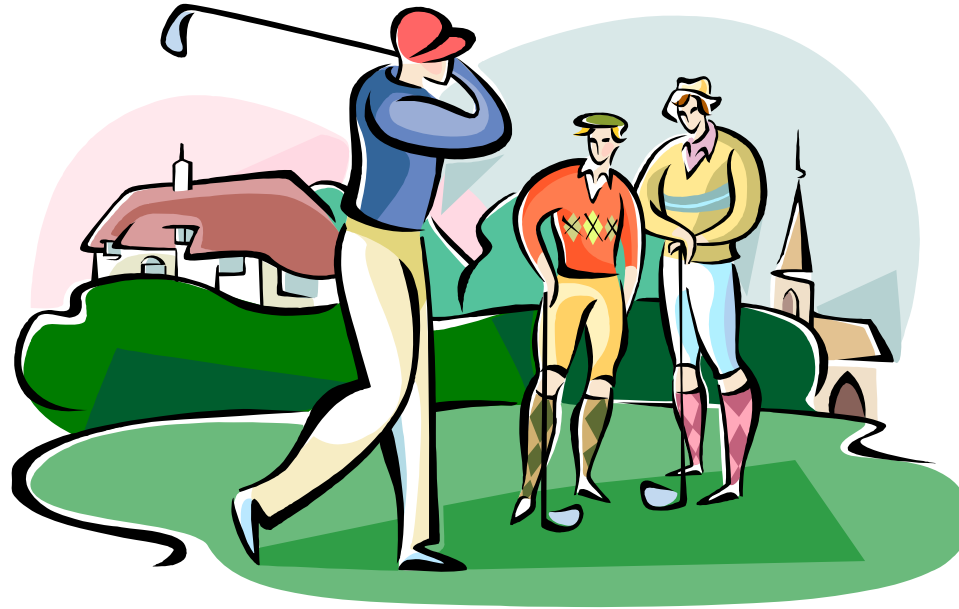


---

*Students should be given problems—at levels appropriate to their maturity—that require them to decide what evidence is relevant and to offer their own interpretations of what the evidence means. . . ., on careful observation and thoughtful analysis. Students need guidance, encouragement, and practice in collecting, sorting, and analyzing evidence, and in building arguments based on it. However, if such activities are not to be destructively boring, they must lead to some intellectually satisfying payoff that students care about. (AAAS, 1989, p. 148).*

---

# Welcome to



# Learning Issues Board

What do we know?      What are our Learning Issues?      What is our Action Plan?

What do we know?	What are our Learning Issues?	What is our Action Plan?

---

PBL is NOT intended to be  
an End-of-Week Curriculum  
Game

PBL is intended to be the **CORE**  
**Curriculum**, Presented  
*Differently*

---

---

# **Instructional Goals of PBL**

**Core Content**  
**Problem Solving**  
**Conceptual Reasoning**  
**Research**  
**Dispositions**  
**Thinking Skills**  
**Ethics**



---

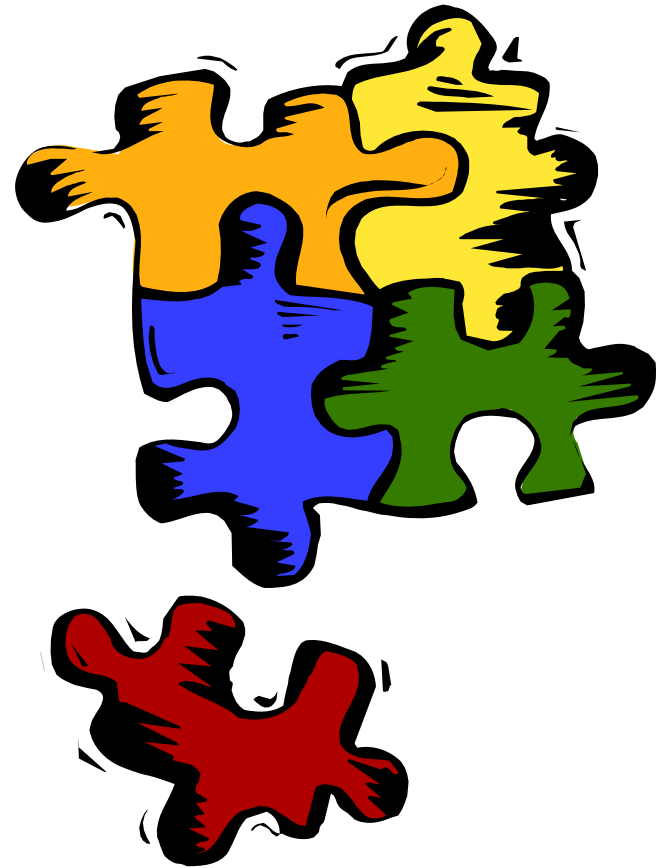
# **Key Components of PBL**

- 1. Initiating Instruction with an Ill-Structured Problem**
  - 2. Student-as-Stakeholder**
  - 3. 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 solution**
- **Can change with new information**
- **Is ambiguous and unclear**



---

# The Benefit of Ill-Structured Problems

While working with **ill-structured problems**, students are more likely to develop

*a significant body of content knowledge* and make meaningful use of it when necessary;

consciously *regulate their own thinking*, particularly when selecting and evaluating strategies and monitoring progress towards a solution; and

develop *defensible, evidence-driven arguments* for the solutions they think are preferable under different circumstances.

Shin & McGee (2003)

---

# Benefits of Ill-Structured Problems

- Authenticity and Relevance (Situated Cognition)
- Hard Wired
- Right Brain
- Tolerate Ambiguity
- Take Risks
- Forward Problem Solving
- Encourages Advanced Epistemology



---

# *Iowa Education Standards and Benchmarks*

## **The Nature of Science**

- Use appropriate tools and techniques to gather, process, and analyze data.
- Recognize that scientists perform different types of investigations. Follow appropriate safety procedures when conducting investigations.
- Use evidence to develop reasonable explanations. Plan and conduct scientific investigations.
- Incorporate mathematics in science inquiries.
- Communicate scientific procedures and explanations.
- Identify and generate questions that can be answered through scientific investigations

---

# *Iowa Education Standards and Benchmarks*

## Earth and Life Science

- Students can understand the structures of living things
- Students can understand environmental interaction and adaptation.

## Language Arts

- Understand stated information
- Determine the meaning of new words from their context
- Draw conclusions, make inferences, and deduce meaning

---

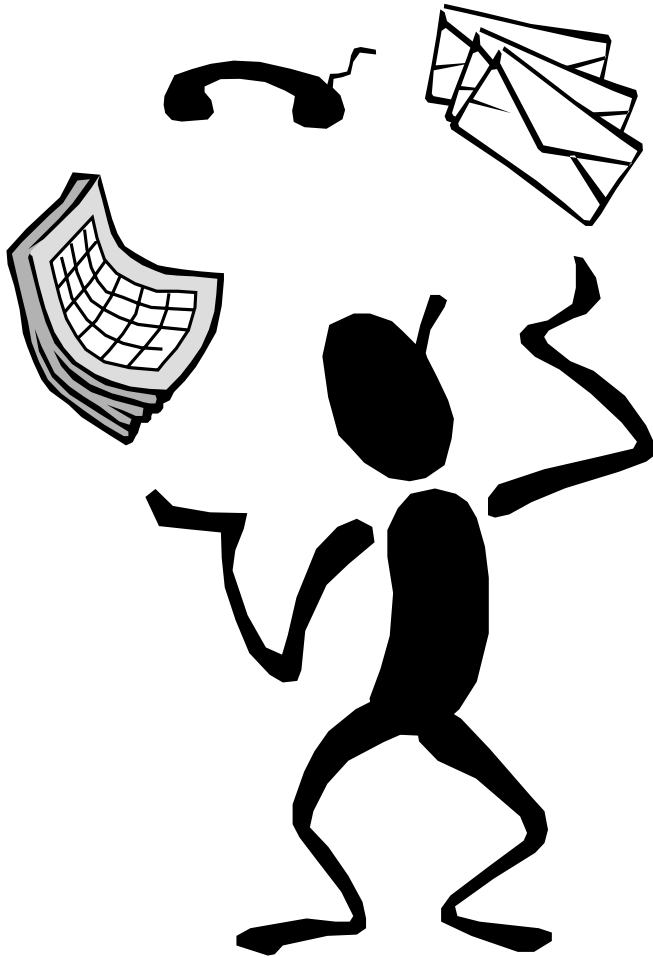
# *Iowa Education Standards and Benchmarks*

## **Social Studies**

- Understand current social issues to determine how the individual formulates opinions and responds to issues.
  - Understand the process of how humans develop, learn, adapt to the environment, and internalize their culture.
  - Understand the changing nature of society.
  - Understand the influences on individual and group behavior and group decision making.
  - Understand how personality and socialization impact the individual.
- Understand how to evaluate social research and information.

---

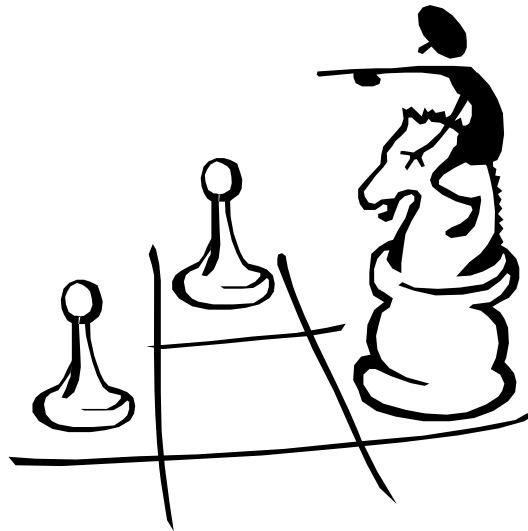
# *Student-As-Stakeholder*



- **Real world problem solvers are not objective: we have perspective (bias)**
  - **Increases ownership**
  - **Provides a form of apprenticeship in a discipline**
-

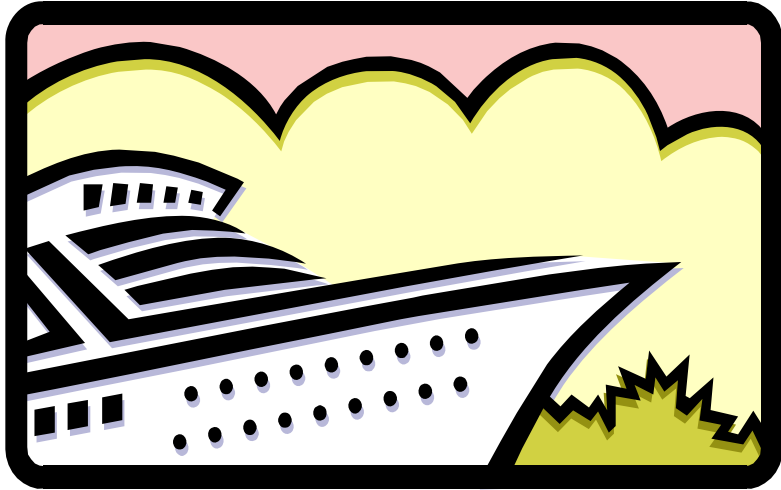
---

# *Metacognitive Coach*



---

# *The PBL Coach*



■ Cruise Director

■ Socrates



---

# *Role of the Tutorial Group*

- motivates self-study
- enhances engagement
- authentic collaboration



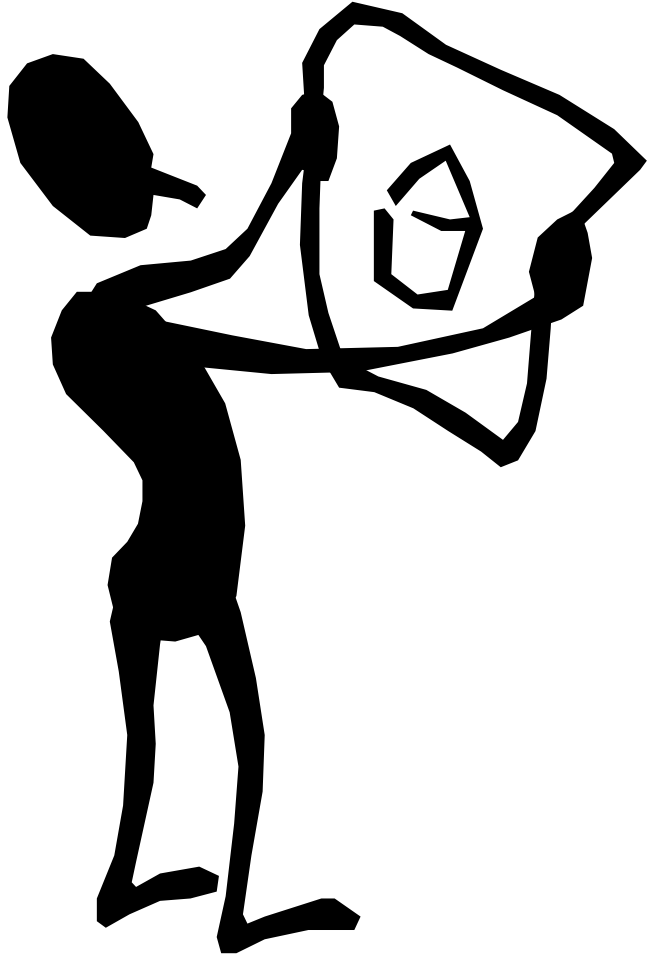
# *The Importance of DISPOSITIONS*

■ Without dispositions of thoughtfulness, neither knowledge nor the tools for applying it are likely to be used intelligently. ...dispositions have attracted the least attention in the professional literature, but a good argument can be made that dispositions are central in generating both the will to think and in developing...qualities of judgment that steer knowledge and skills in productive directions.



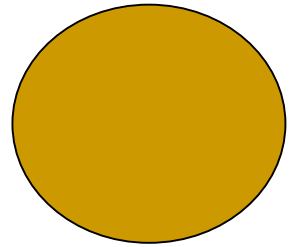
---

# Laying out the Plan...

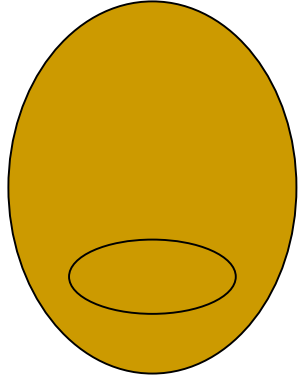


**The  
Flow of  
the  
Problem**



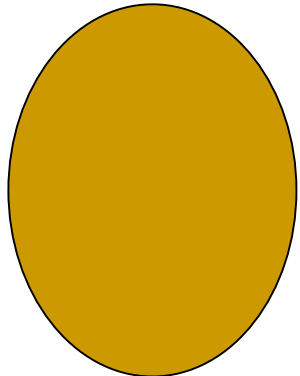


**Engagement**

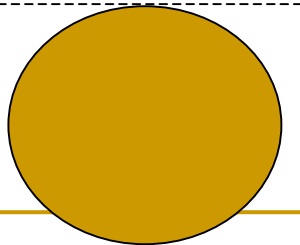


**Inquiry and Investigation**

**Problem Definition**



**Problem Resolution**



**Problem Debriefing**

# **The Flow of the Problem**

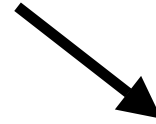
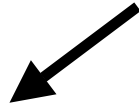
---

# *Embedded Instruction*

- Research Skills
- Interview Techniques
- Letter Writing
- Analysis of Information
- Rules of Interpretation
- Question Asking
- Reflection

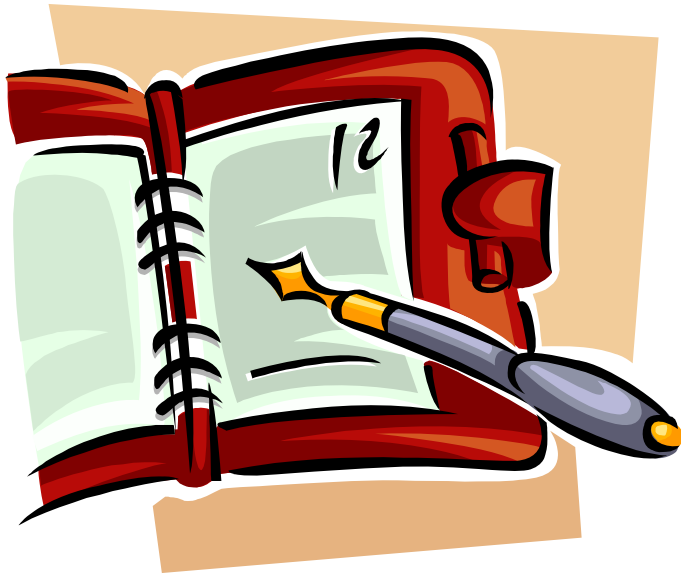


# Assessment



The Problem Log

Classroom Rubrics



---

# *Efficacy: Does it Work?*

## *Content*

either equal or greater content acquisition in PBL when compared to traditional instruction (Dods, 1997; Gallagher, 2001; Gallagher & Stepien, 1996; Geban, Sungar, & Ceren, 2006; Hmelo-Silver, 2004; Van Tassel-Baska, Bracken, Stamabaugh, & Feng, 2007; Verhoeven et al, 1998).

---

# *Efficacy: Does it Work?*

## *Skills*

When embedded into a PBL unit students learn to use rules of argumentation (Belland, Glazewski, & Richardson, 2008), experimental method (Feng, Van Tassel-Baska, Quek, O'Neil, & Bai, 2005) problem finding (Gallagher, Stepien, & Rosenthal, 1997), and analysis (VanTassel-Baska, Bass, Ries, Poland, & Avery, 1998; Van Tassel-Baska, Bracken, et al., 2007).

---

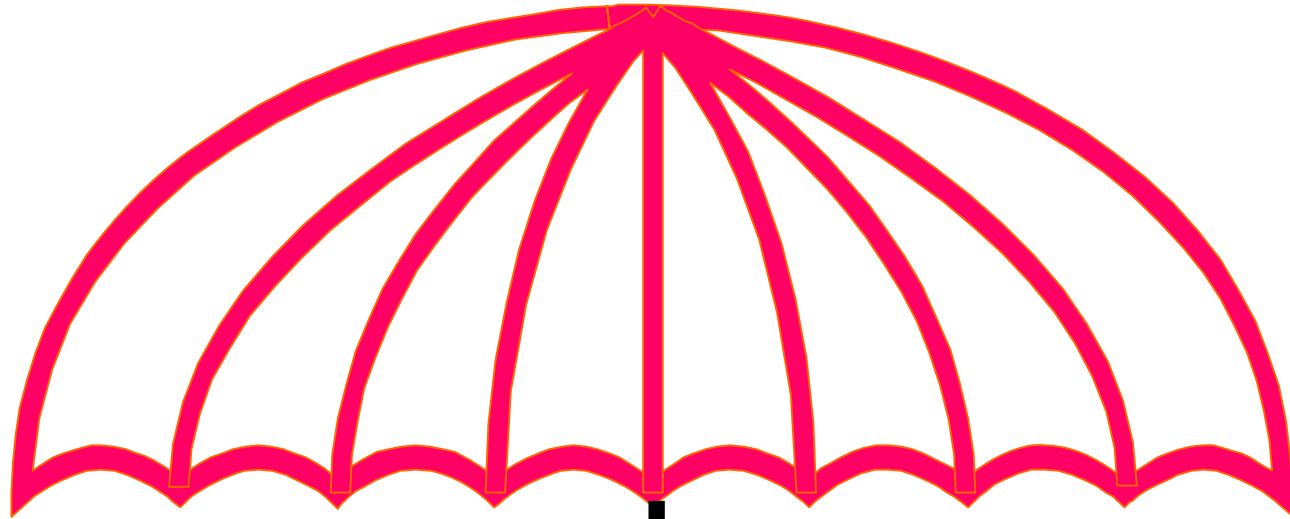
# *Efficacy: Does it Work?*

## *Metacognition*

As early as first grade children students can learn peer tutoring and metacognitive reasoning through PBL (Shamir, Zion & Spector-Levi 2008).

---

*Efficacy: Does it Work?*  
*Engagement*



## **Engaging for ALL**

Grass Growth

Ecosystems

Map Reading

Communication

Group work on  
Research,  
Presentations

## **Differentiated for Gifted**

Habits

Of  
Mind

Interdependence, Good and Bad

Compare/Contrast

Intended and Unintended  
Consequences

Problem Solving