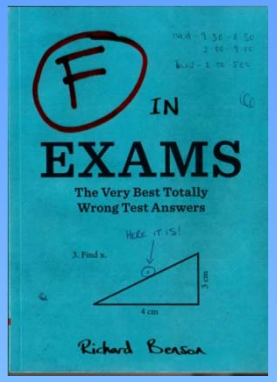
Many people don't like eating radiation-treated food. How could a food scientist prove that radiation-treated food is safe?

By eating some!



Give a reason why people would want to live near power lines.

You get your electricity faster.

Science from Richard Benson

Describe the shape and structure of the Milky Way.

It's kind of like a long, bumpy rectangle. It's completely covered in milk chocolate, but inside there are two delicious layers: chocolaty nougat and caramel.

Wednesday – 20 July 2011
Today's schedule

8:30 – 9:30 am	Introductory session – our first science experiment?… Grasshoppers – example lesson illustrating questioning
9:30 – 11:15 am	Developing our second set of modeling modules include a break,
11:15 – Noon	Whiteboards before lunch (preliminary ideas)
Noon - 12:30	Lunch
12:30 – 1:30 pm	A membrane experiment the modeling way
1:30 – 3:00 pm	Completing the second module set – written documents
3:00 – 3:20 pm	A couple of whiteboards? Discussion about our progress; the next module set – [Overview as we see it (tomorrow morning)]–
3:20 - 3:30 pm	A little homework, reflections!

Another SIP OF SCIENCE

Satisfying, Intentional Problem- Solving

Hypothesis:

GOOD QUESTIONS

can lead to

EFFECTIVE SCIENTIFIC INQUIRY

And

Science learning/understanding

Natural connections to your literacy/reading and social science (and math!) curriculum

“How to read an object”

– scientifically……

WHO OWNS THE QUESTIONS in EFFICACIOUS LEARNING?

the learners ask the questions!

Can learners problem-solve around

Big Idea Questions?

An example "reading an object" lesson

:

WHAT DO YOU KNOW about Grasshoppers?

Step 1: What do you know?

Use one page of your notebook

1. **Draw a grasshopper**
2. **Come up with 2 or 3 questions you have as a result of this drawing**

Keep it "RAW"

Representing And Wondering

3. **Show your drawing to your neighbor, revise your questions….**

WHAT DO YOU KNOW about Grasshoppers?

Step 2: Pictorial Understanding

Here is a picture of a grasshopper

1. **Draw your own picture**
2. **Come up with 2 or 3 questions you have as a result of this drawing**
3. **Discuss your drawing with your neighbor and revise your questions**

WHAT DO YOU KNOW about Grasshoppers?
Step 3 : Symbolic Understanding

1. **Draw a "scientific" (with labels) of a grasshopper**

Discuss with your neighbor

a further (scientific) investigation you might be interested in doing about cotton.

Write it down in your notebook

Discuss with your neighbor

a further (scientific) investigation you might be interested in doing about grasshoppers.

What kind of **Learning Path** does the process we just did reflect?

All learning

Begins with Concrete

Moves to the Pictorial

And then to the Symbolic

It is all INVESTIGATIVE

(by the LEARNER)

What kinds of questions are characteristic in your classrooms?

- *Q&A Ping Pong*
- *Teacher wondering questions*
- *Learner wonder/wander questions in the course of a guided inquiry.*

"The Ladder" of Questions…

Level	Level of Inquiry	Developmental Trajectory
3	**Evaluating/ Synthesizing inquiry**—explores fully open-ended questions • Emphasis on *why* questions, questions that make *text to self, text to text, text to world* connections • No single right answer; in fact, responses are often varied and may lead to a new direction • A good response will be supported with examples and connections • Response involves discussion/ conversation as the responder expresses, clarifies, and extends thinking • Calls for active listening and facilitating on questioner's part; questions may need to be rephrased or prompts given	***Abstract Symbolic Thinking*** • At all stages of development, this kind of inquiry tends to elicit high engagement and satisfaction because the responder "owns" the discussion and is constructing personal understanding. Such inquiry typically goes beyond the classroom and may be seen in children's play. • The '5 to 7 shift' marks the transition from early to mid- childhood. In this period, children gradually increase their ability to abstract and to reason. • Before, and in the early part of this stage, children's evaluative statements tend to be based on a specific/concrete factor. • In the next 4-5 years, between 7 and 12, children's ability to generalize and engage in abstract thought goes through another significant development.
2	**Analyzing/ Applying inquiry** –explores leading to open ended questions, • Emphasis on *how, why,* some *what* questions; includes comparison/ contrast; categorizing • No single right answer but a "good" answer may need to include a certain amount of information/facts in support (leading questions) • Response involves discussion/ conversation as the responder expresses, clarifies, and extends thinking • Calls for active listening and facilitating on questioner's part—questions may need to be rephrased or prompts given	***Pictorial*** • This is a *transitional* point between concrete and the abstract thinking and understanding. At this stage, there is some generalization in terms of developing schema or frameworks. However, the analysis or application is based on concrete data or ideas. • While young children in the concrete stage of development are very capable of analyzing/applying, their explanations tend to reflect direct experience or literal details rather than abstractions. • *As children reach the end of the 5-7 shift , their ability to generalize increases and they are able to make more complex inferences about character motivation, cause and effect, etc.*
1	**Knowledge and Comprehension inquiry** –tends to use closed questions • Emphasis on *what, where, when* questions that can be supported by direct reference to the text; • At lowest level, open-and-shut closed questions be call for yes/no or single word responses & are asked test memory (or attention. • Level 1 questions can be **unlocked closed questions**" that such questions call on respondent to visualize, recall, describe, sequence. • Level 2 and 3 inquiries require basic comprehension and knowledge as part of checking facts, building support for an idea, clarifying, & creating connections. • In a *conversation/discussion,* this level inquiry involves active listening and facilitating —questions may need to be rephrased or prompts given.	***Concrete*** All learning/thinking begins with the concrete. • Young children who are still at the concrete level developmentally need extensive opportunities to explain and "unpack" the literal level of meaning . • Novice learners at all stages of development need time to make sense on the concrete and pictorial levels as a foundation to strong conceptual understanding at the symbolic level. • Fully mature learners often move quite quickly from this stage to the symbolic in areas of expertise; At all stages of development when the focus is exclusively or extensively on this level, participants' sense of inquiry or ownership can be lost and learning inhibited by anxiety and poor disposition.

As understanding deepens and develops, we continue to move back and forth between the three levels.