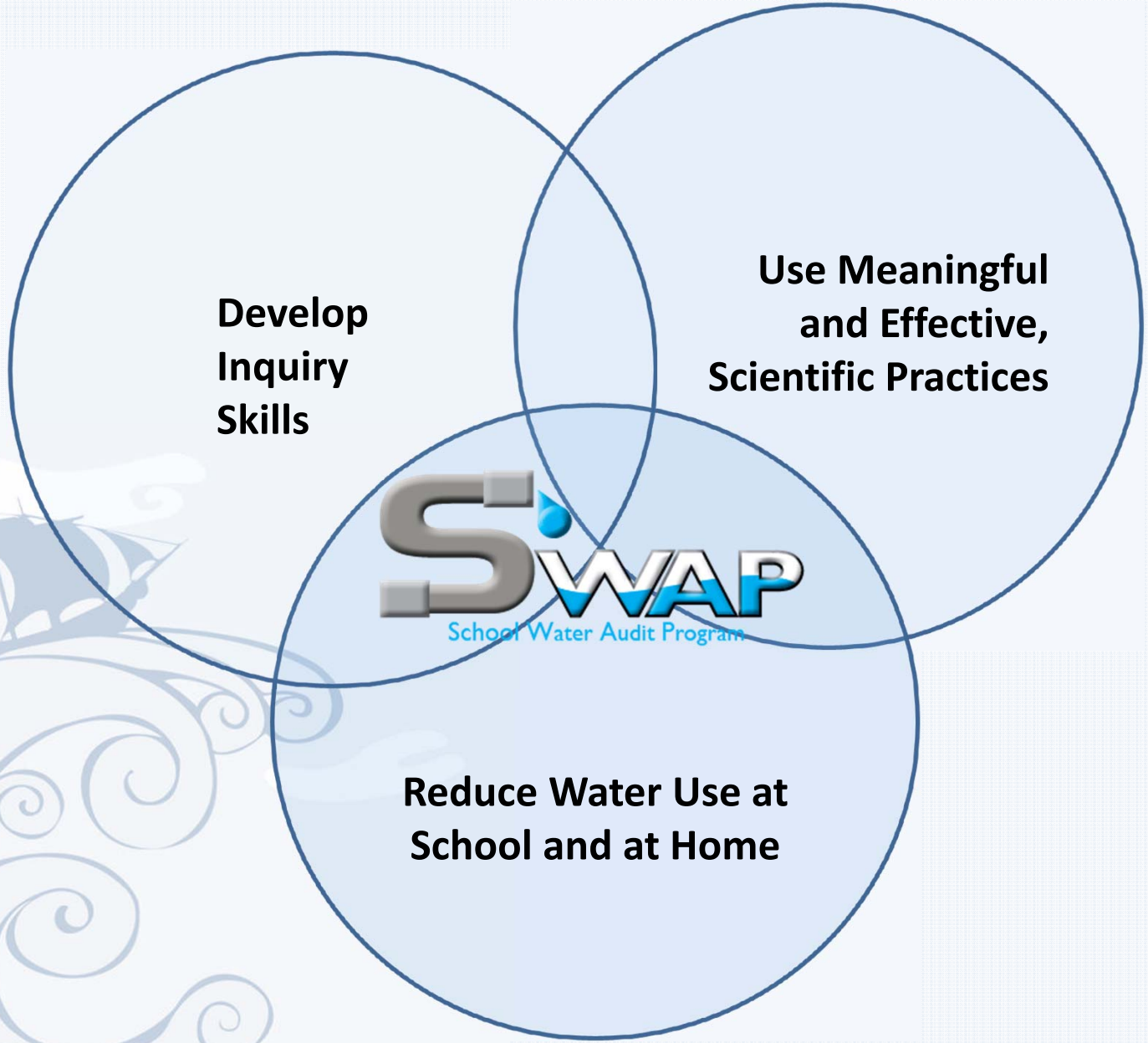

Riding the Wave of Student-Driven Inquiry: Terror or Treasure?

Arizona Project WET
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Sustaining the Blue Planet Conference
September, 2011

Welcome

- Professional development providers
- Value inquiry in the classroom
- Champions of 21st Century Learning skills
- Supporters of teachers in the classroom

Student-Driven Inquiry

"Your mind opens up and you want to do all these different things!"

—Open-inquiry lab student

- Students are excited and passionate about their work
- Students think critically to make choices and extract meaning from their experiences
- A culture of choice and ownership promotes student achievement

Why doesn't *EVERY* teacher employ inquiry?

Inquiry is a multifaceted activity that involves making observations; posing questions; examining books and other sources of information to see what is already known; planning investigations; reviewing what is already known in light of experimental evidence; using tools to gather, analyze, and interpret data; proposing answers, explanations, and predictions; and communicating the results. Inquiry requires identification of assumptions, use of critical and logical thinking, and consideration of alternative explanations.

National Science Education Standards, 1996

Why doesn't *EVERY* teacher employ inquiry?

- There are many misconceptions about what inquiry teaching is:
  - Doing hands-on science is inquiry
  - The Scientific Method is inquiry
  - All science should be taught through inquiry
  - Inquiry outcomes are unpredictable
  - Inquiry means the students control everything

Why doesn't *EVERY* teacher employ inquiry?

- Teachers fear
  - losing control of student behavior (it's a free-for-all!)
  - inquiry will lack content specificity and rigor (and they won't be able to meet the standards)
  - they don't have enough time to do inquiry
  - students might ask questions for which they do not (yet) have the answers
  - inquiry does not look like they are 'teaching'

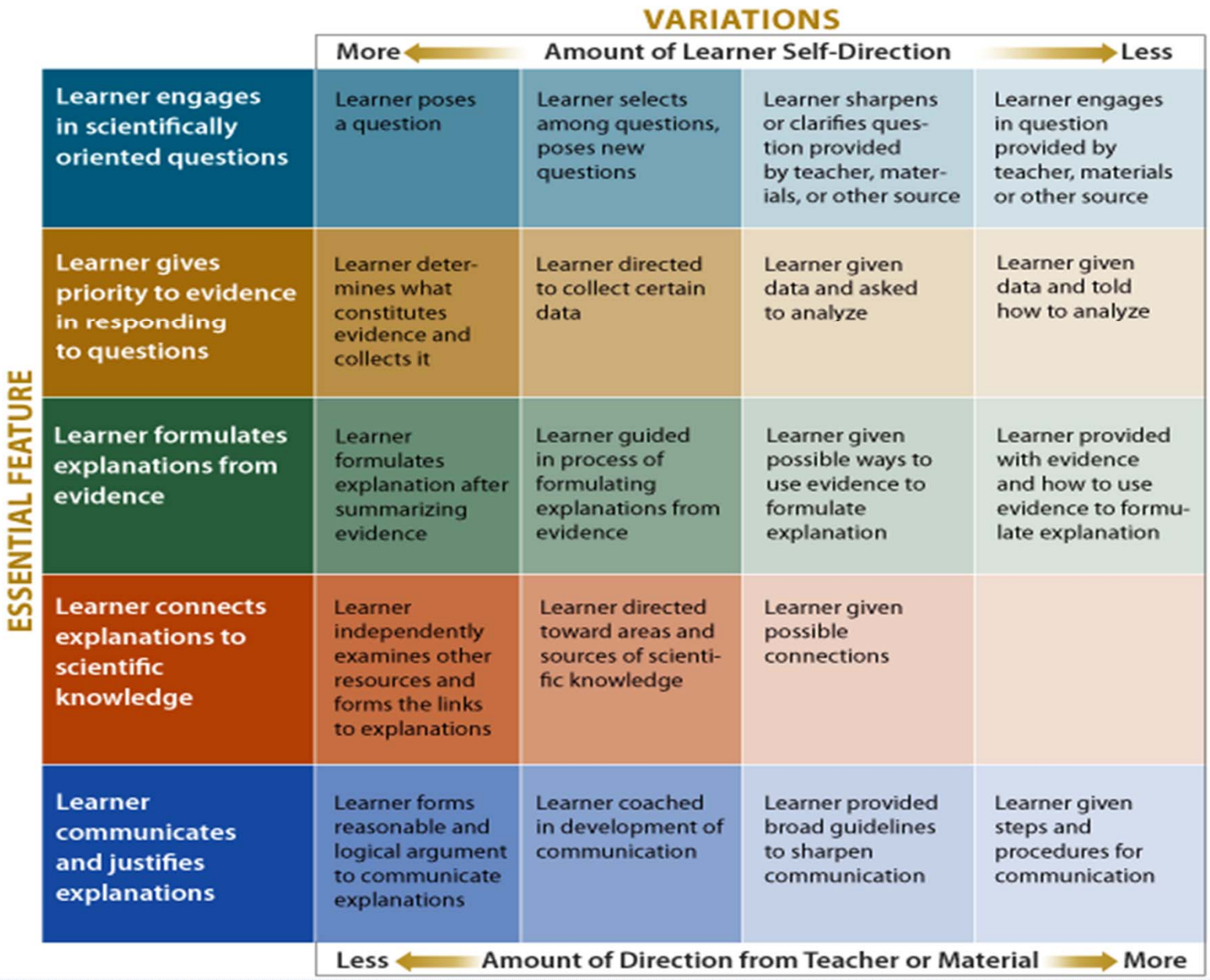
How can WE as professional development providers help teachers overcome their barriers?

Clearly Define Inquiry

Five Essential Features

1. Learners are engaged by scientifically oriented questions.
2. Learners give priority to evidence, which allows them to develop and evaluate explanations that address scientifically oriented questions.
3. Learners formulate explanations from evidence to address scientifically oriented questions.
4. Learners evaluate their explanations in light of alternative explanations, particularly those reflecting scientific understanding.
5. Learners communicate and justify their proposed explanations.

Inquiry and the National Science Education Standards:
A Guide for Teaching and Learning (NRC 2000).



New Teacher Center Community of Practice
http://community.newteachercenter.org/node/266

Practice Inquiry

- Keep a notebook *and write in it*!
- Observe, examine, look, ponder
- Ask questions and speculate
- Wonder
  - I wonder if . .
  - What if . . .
- Read/research, connect with scientific thought
- Test your thoughts
- Use experience to revise thoughts and assumptions
- Share, communicate

Model Teaching Through Inquiry

- Adapt PW lessons to open-inquiry lessons

Just Passing Through

1. View slope photos and speculate on behavior
2. Whole-body simulation
    1. water on a vegetated slope
    2. water on a bare slope
    3. Erosion on a vegetated slope
    4. Erosion on a bare slope
3. Discuss this experience
4. Assess via written descriptions

Can there be MORE inquiry?

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Can there be MORE inquiry?

Focus Question: How does water on a bare slope move differently than water on a slope covered with plants?

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Can there be MORE inquiry?

Focus **Question**

Predict: Examine the photos, observe differences, predict how water will behave differently on each slope

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Can there be MORE inquiry?

Focus **Question**

Predict

Observe: run simulations of water on vegetated slope, bare slope, with and without errosion

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Can there be MORE inquiry?

Focus **Question**

Predict

Observe

Explain: based on the observations, why did the system react as it did?

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Can there be MORE inquiry?

Focus **Question**

Predict – Observe – Explain

Evaluate explanation: Research what others have to say about water on a slope

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Can there be MORE inquiry?

Focus **Question**

Predict – Observe – Explain

Evaluate Explanation

Ask “what if . . . “ and “I wonder” questions. Investigate those questions.

Model Teaching Through Inquiry

- Adapt PW lessons to open-inquiry lessons

Just Passing Through

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Can there be MORE inquiry?

Focus **Question**

Predict – Observe – Explain

Evaluate Explanation

Investigate

Use new experience to refine explanation.

Communicate: share findings with others!

Model Teaching Through Inquiry

- Demonstrate the use of the Inquiry Continuum to scaffold inquiry teaching

Try This:		Essential Feature
Provide question and data to analyze	→	Engage in scientific questions and give priority to evidence
Demonstrate; Predict – Observe – Explain	→	Develop explanations
P-O-E, research, revise explanation	→	Evaluate explanations and connect to scientific concepts
Write "I wonder . . . " and "What if . . . " questions then test new explanations	→	Evaluate explanations and connect to scientific concepts
Report results and conclusions	→	Communicate and Justify Explanations

Address Fears

Teachers fear

- losing control
- lack content specificity and rigor
- insufficient time
- Insufficient content knowledge
- doesn’t LOOK like 'teaching'

Avoid the pitfalls

- Set rules and routines specific to inquiry activities
- Set the stage
- Question to reach for higher levels on Bloom’s Taxonomy
- Set high expectations
- Don’t forget literature research
- Use science notebooks
- Educate administrators and parents

Provide Practical Tools

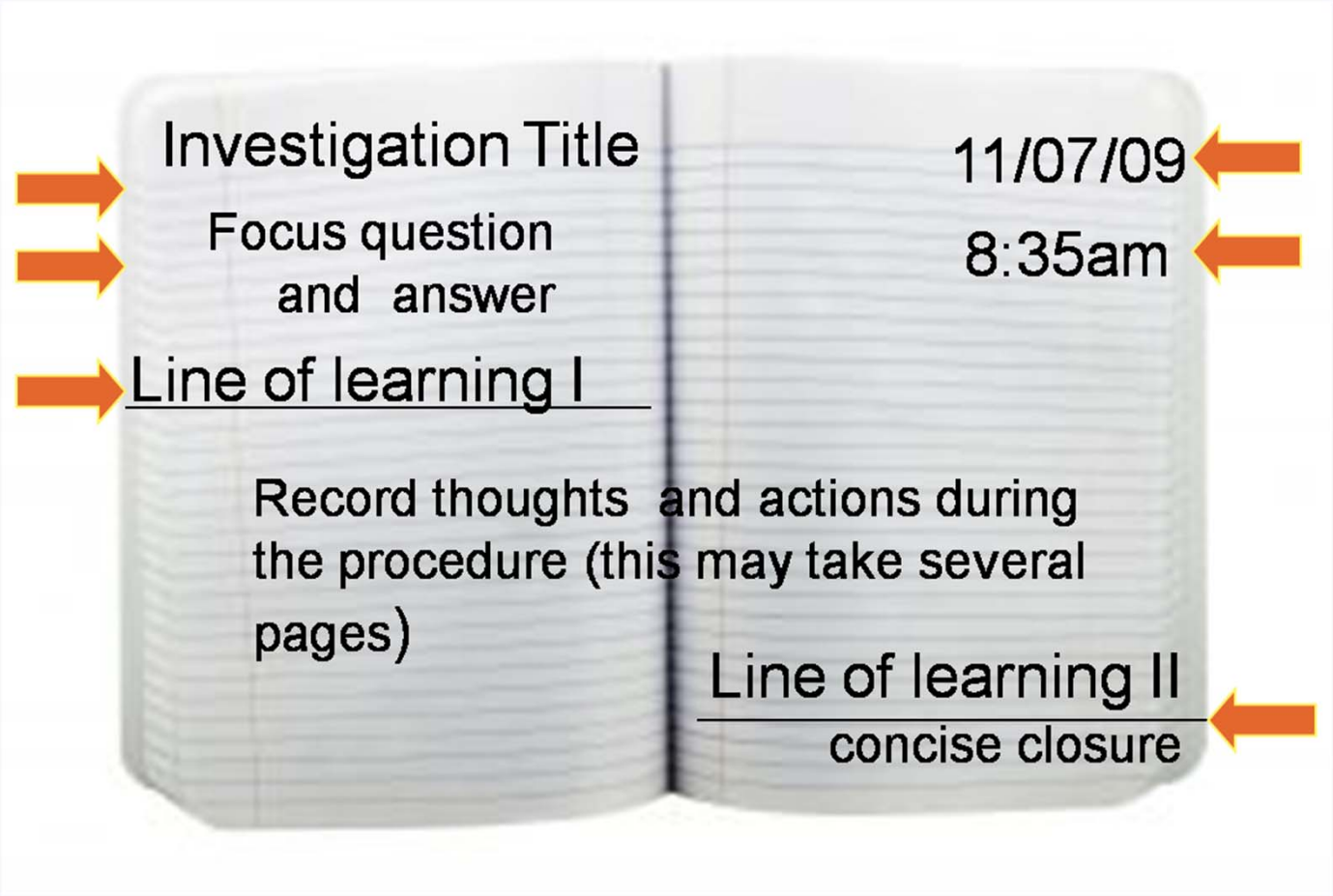
Avoid the pitfalls of learning to use Inquiry	
Use guiding questions to empower students to answer their own questions	Student-driven content isn't beyond the teacher when teacher and student are co-learners
Celebrate student inquiry outcomes	The proof (of the effectiveness and value of inquiry) is in the pudding. Share these widely and freely.
Share resources regarding the value of inquiry with peers, administrators, and parents.	Change is difficult; critical observers will value your confidence and the credibility that educational research can lend to your efforts.

Avoid the pitfalls of learning to use Inquiry	. . . .
Set clear expectations for behavior; practice behavior control systems	Inquiry doesn't have to be chaos if students know how to behave

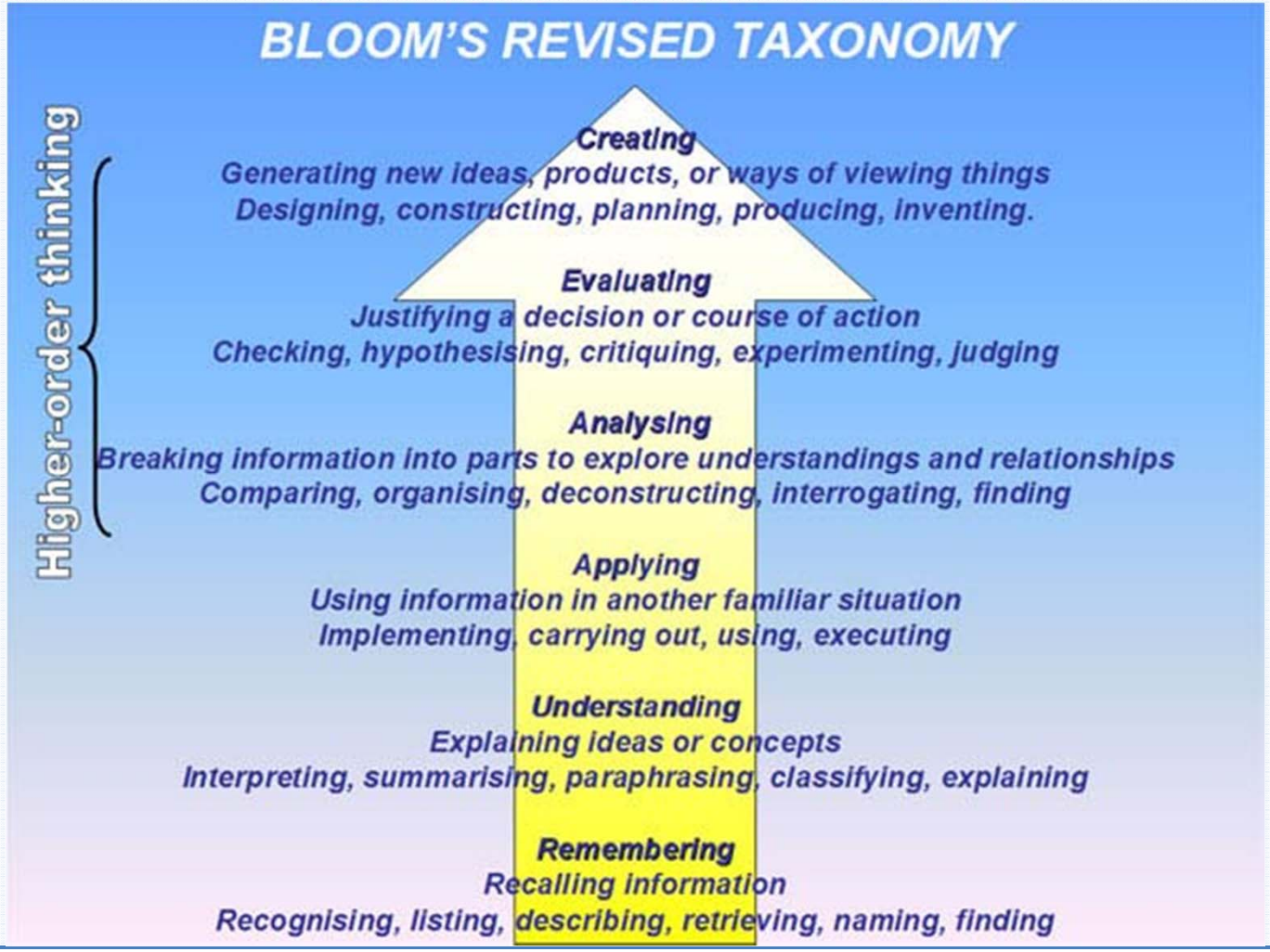
". . . during the first weeks of school I spend A LOT of time on expectations, what does "on task" look like and sound like? What does a good drawing look like? Basically skills and behavior that we come back to over and over during the year, but less and less do I have to 'control'."

"I'm pretty sure the kids in her school could do inquiry science all the time, because they have been taught to be respectful of each other and committed to performing for the best interests of everyone."

Avoid the pitfalls of learning to use Inquiry	. . . .
Use science notebooks	Writing and verbalizing throughout inquiry studies will help to develop student critical thinking skills.



Avoid the pitfalls of learning to use Inquiry	. . . .
Develop your own questioning skills to reach for higher levels on Bloom's Taxonomy	Move students beyond recall; provide models of good questioning for students.



Avoid the pitfalls of learning to use Inquiry	. . . .
Develop and use an Inquiry Monitoring Chart; share it with students	Set clear expectations for inquiry practices to ensure students engage in inquiry rather than play

Initial Investigation	+	✓	-
Verbalizes observations			
Writes own and team members' observations in notebook			
Sketches accurately, including labels			
Writes multiple "What if . . . ." and/or "I wonder . . . ." questions			
Developing a Question	**+**	**✓**	**-**
Sorts questions into "testable," "needs revision," and "expert to answer" categories			
Refines questions to optimum testability			
Prioritizes questions and helps select target question for investigation			
Identifies manipulated variable, resulting variable, and controlled variables			

My Inquiry Practice

- Keep a notebook *and write in it*!
- Observe, examine, look, ponder
- Ask questions: How to get teachers to do REAL student-driven inquiry?
- Wonder
  - I wonder if . . .
  - What if . . .
- Read/research, connect with scientific thought
- Test your thoughts: 2010-2011 teacher cohort
- Use experience to revise thoughts and assumptions
- Share, communicate: Sustaining the Blue Planet

So What?

- Educators make up our primary audience
- To attract your audience, you must know your audience:
  - Demand for more effective STEM education
  - Little budget or no budget
  - Intense worries about personal time and classroom time
  - Administrations are hyper-focused on standards and testing
- To attract and keep your audience you must give them the most value for their time and money

Ride the Wave!