"How Do We Plan for Students' Questions?"

4

Very often I am asked how we plan for the wide variety of students' questions in advance. A variant on this question is, "How do we conduct inquiry and still meet local and state standards?"

For me this question takes us directly to curriculum planning, a process we must engage in prior to launching our unit if we want it to be as successful as possible. When we think of planning a unit we are, of course, going to identify our major concepts and subtopics; we may identify essential questions as well as specific objectives.

Sometimes I work with teachers who are in the middle of a unit of instruction and they're not really sure what they want students to be able to do by the end of the unit. They haven't determined the most important concepts and how they might assess these at the end of the unit.

For this, we need to spend some time planning the concepts we wish students to think about productively. This is what this chapter is all about—in-depth curriculum planning that will help us plan for students' deep understanding of concepts, ideas, and skills.

Our process will build on the work we have already done to create an environment that invites students to freely raise good questions and seek reasonable answers.

One aspect of this process that might be unique is the creation of problematic scenarios or situations to intrigue students and foster their desire to become involved. In other words, we will think about how to draw on the research in Chapter 2 on what fosters curiosity and exploration, what

draws us into a situation so we begin to wonder and think about it. How do we tap into students' desire to think critically and creatively?

A MODEL INITIATING A PROBLEMATIC SCENARIO

Recall what John Dewey (1910) claimed in *How We Think*, that "the origin of thinking is some perplexity, confusion, or doubt" (http://www.ed.uiuc.edu/EPS/PES-yearbook/96_docs/thompson.html, accessed May, 2007). Dewey continues, "A question to be answered, an ambiguity to be resolved, sets up an end and holds the current of ideas to a definite channel." We can take a lead from Dewey's very pragmatic approach to inquiry—finding some situation fraught with doubt, complexity, novelty, fascination, and mystery that invites students' attention.

Think back to *Made to Stick—Why Some Ideas Survive and Others Die* (C. Heath & D. Heath, 2007). One component of "stickiness" is unexpectedness, being counterintuitive, violating our expectations. We are looking for situations within our curriculum unit that will invite inquiry because they are simple, and concrete, relate to our emotions, tell a story, and cause us to sit up and say, "Wait a minute. That's fascinating!" I call these kinds of difficult, challenging situations "problematic scenarios" and here is a model.

In working with educators over the past several years, I have used the following problematic scenario as a model. It comes from Carol Cutrupi's (personal communication, 2000) third-grade classroom in Paramus, New Jersey.

> You are responsible for finding a way (or ways) to stop the destruction of the ocean so that the animal or plant life that you have chosen and researched can remain a part of the ocean community. You must find a way to show that your method of saving the ocean will help not only the species that you have chosen, but will also help to preserve all of the living and non-living things that the species is dependent on, and all of the things that are a part of the ocean community that depend on it (interdependence).

REFLECTIVE PAUSE

What do you like about this problem as a way to initiate average third graders into a long study of the oceans? What aspects do you find particularly helpful? How does Carol's problematic scenario differ from the "usual" way of introducing this kind of unit?

What teachers usually identify is the high level of intellectual challenge present here. Students identify a species they are interested in; determine the extent of endangerment to this species; figure out what the ecological web of interdependencies is and how to help preserve this species for the future.

Let's just pause here to consider what's involved:

1. To make a selection from among all the creatures in the ocean, students must know a fair amount about several of them. They will then compare them with each other and draw a conclusion: "I want to work on the clown fish." As we mentioned in Chapter 2, the process of observing and making distinctions and classifications fosters intellectual development (Copple, Sigel, & Saunders, 1984).

2. Then they need to identify a problem and solve it. This means generating alternative solutions and being able, once again, to make a decision—excellent problem-solving processes.

Another aspect of this problematic scenario that I especially appreciate, and have tried to replicate below, is that there is an authentic assessment built into it. Students know exactly what they must know and demonstrate a clear understanding of. They need to use the criteria of dependence and interdependence in order to decide on a satisfactory solution. Remember that every change we make to an ecosystem has ramifications for so many other species, not merely the one we're focusing on. One change ripples throughout the system like a pebble dropped into a small pond.

Easy for third graders? No, says Carol, but given sufficient time (she might spend eight weeks on this unit because at the time her school had oceans as a year long theme), resources, and support from Carol and her colleagues, this is very doable.

Let me stress one more time that having a direction for our inquiry as Dewey suggested and Carol has illustrated is most important to guide any unit of instruction. See the end of this chapter for more examples.

We have mentioned those characteristics that foster curiosity and exploration (doubt, difficulty, novelty, mystery, and so forth). Let's consider Figure 4.1 for other elements found within these problematic scenarios.

When designing our problematic scenarios, we might use several of these as criteria for our self-assessment.

Now, onto a method for developing such a scenario.

> ### Fig 4.1 Characteristics of Problematic Scenarios
>
> **Doubt, difficulty, uncertainty, novelty, and mystery**—That which fosters curiosity and invites exploration (Berlyne, as cited in Kashdan, Rose, & Fincham, 2004; Copple et al., 1984; Dewey, 1910).
>
> **Complexity**—That which possesses many facets, elements, or ways of investigating. As Marzano (2003, p. 150) reminds us, complexity arouses curiosity because we aren't sure of outcomes and there are many facets to explore.
>
> **Boundarylessness**—That which is open to question, problem solving, and multiple entry points where people with different interests participate—not given to top-down solutions. A term derived from Jack Welch's work with GE (Welch, 2001, p. 186).
>
> **Robust**—Concepts are significant within the unit and curriculum (e.g., dependence, interdependence, ocean ecologies, and conservation).
>
> **Researchable**—Information is available from a variety of sources.
>
> **Transferability**—Concepts may have meaning within other subjects and life contexts.
>
> **Fascination**—That which captures imagination of our students.
>
> **"Stickiness"**—That which is simple, concrete, unexpected, credible, emotional, and story-like.

What I will outline next is an approach I have used with teachers, both preservice and experienced, in order to help us plan instruction that is mentally, emotionally, and perhaps physically challenging and that leads to deep and extensive understanding of major concepts. That is always, always our goal—high levels of challenge for all students, not just the average or "gifted and talented" students, but all students.

THE PLANNING WEB

One approach I have worked with for many years as a curriculum development person involves the following steps:

A. Identify the topic for a unit.
B. Create a concept map with this concept/topic in the center and web out all of the associations you can make—this will include some of the following:
1. Names of related persons; significant dates
2. Associated ideas/subtopics that reflect different points of view: history, culture, art, science, mathematics, philosophy, literature, and so forth
3. Historical/causal factors
4. Current manifestations and related issues
5. Future projections

Here we are "brainstorming" all possible connections and references without any self-monitoring or evaluating. Whatever we think of goes onto the concept map.

C. Then we begin a selection process. What elements/aspects/factors do we want to challenge our students to think about? These selections will be made on the basis of students' age/grades, intellectual abilities, and interests; the nature of our curriculum goals/objectives; and content/state/local standards.

Thus far, we have mapped out for ourselves, or with colleagues, all possible content—the ideas and concepts we want to teach. This is a most important process because without it we have to think on our feet while confronted with all students' ideas and questions about where we want to go and this reflects a lack of planning. The old saying is, "If you don't know where you're going, any road will take you there." Sometimes this is appropriate, but not usually in our classrooms.

D. Now, we consider one of the most important aspects of inquiry-based instruction: the problematic scenario. A problematic scenario is a situation/experience/object that is **novel, complex, fascinating, intriguing, and somewhat mysterious** such that it will invite students' to pay attention, want to investigate, ask questions about, and seek answers. Anything that invites our attention—a strange-looking rock, a conflict within a community, a sudden burst of light in the heavens—can invite our curiosity. Psychologists sometimes call these "discrepant events," or experiences that jar, startle, or challenge our normal routines,

perceptions, and assumptions. (One teacher recently noted such an event when told, "Penguins don't live north of the equator." She had always assumed they did, so she started her own personal investigation.) We'll give several examples next. Be it noted here that any initial problematic scenario can and, in many instances, should form the basis of our final, summative assessment. Students deserve to know what we expect of them.

E. Then we can identify our specific curricular objectives. What is it we want students to be able to do by the end of this unit of inquiry? With which intellectual skills, problem-solving, creating, experimenting, will they engage the significant concepts and ideas within the unit? These might be suggested by our district, state, and national curricular standards as well as by our paying attention to our own students' needs, interests, and abilities.

F. Once we have our objectives, we can map out our strategy. We will plan these kinds of experiences:

1. Initiating experiences that introduce the unit, tap into prior knowledge, and generate questions/wonderings
2. Core experiences where we conduct our investigations and think critically about findings
3. And culminating experiences (including authentic assessments)

G. And, finally, we plan out various assessments, which are formative as well as summative.

Now, I have suggested this series of steps as those we can do on our own and/or with colleagues during planning sessions. What is evident in working with teachers is that we all have various ways of undertaking this process. Some of us do it in our heads prior to a unit; some of us use a format that calls for main concepts, objectives and an instructional sequence including assessments.

Before I began teaching in New York City after serving in the U.S. Navy, I had the good fortune to take a methods course with a principal from Morris High School in the Bronx, a wonderful educator whose name has slipped the boundaries of memory, unfortunately. He guided me in the rigors of lesson planning and, perhaps, unit design.

I have never met any educators in public schools who do not in some fashion engage in a planning process that calls for them to identify significant elements of their major concepts beforehand. Only at Montclair State University when I was working with several colleagues to identify how they challenged students to think (Barell, 1988), did I encounter educators who said, in effect, that they never plan ahead, that they just go in there and start

and let the class go where it wants. Ah, such luxuries we all have occasionally, as with reading books and perhaps going on exploratory trips. But most of us need to think about where we want to go in advance. This doesn't mean that we plan all students' questions. What it means is that we map out a framework within which we expect their questions to lie.

A MODEL PLANNING EXPERIENCE—"HOW DOES LIFE BEGIN FOR FISH?"

Grade: 3
Students: Average Abilities
Location—Any school, inner city, suburban, rural, mountain
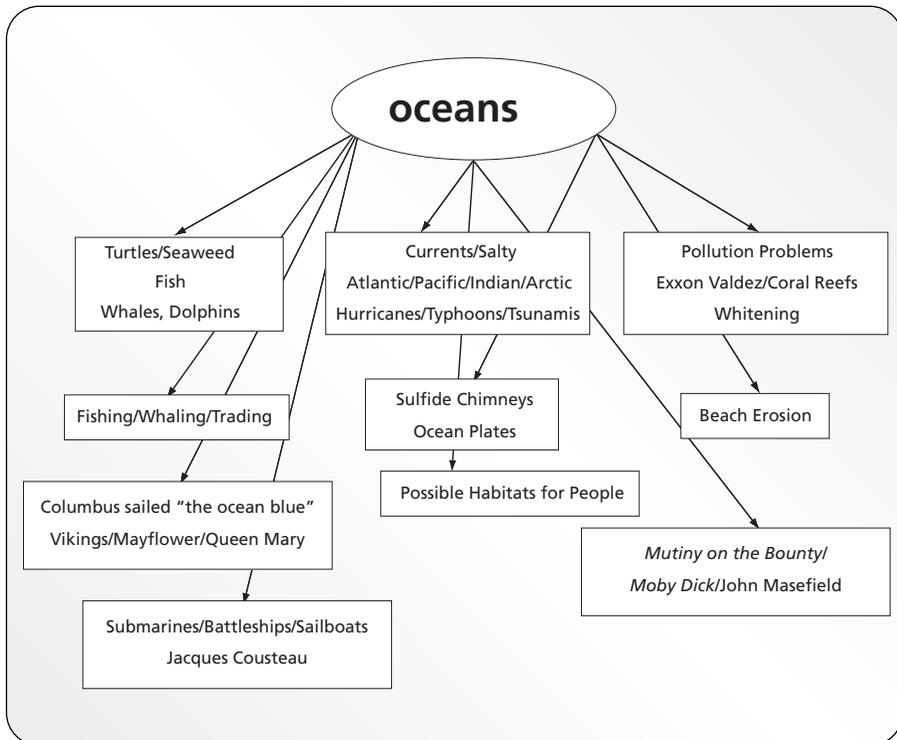
1. Concept: Oceans of the World

2. Map out all possible subtopics/elements:

3. Now think about our third graders and the curriculum: What does the latter call for in terms of thinking about oceans? What do state standards call for? And what are our students most likely to be fascinated by? These criteria will help us select those elements to deal with from the concept webbing.

What would be your selections? Here are some possibilities:

—— Sea life and their habitats
—— Sea travelers like Columbus and other explorers
—— Nature of the sea: salt, currents, storms
—— Pollution problems
—— Different modes of sea transportation

What might be some major ideas we would consider as part of the major concept of oceans? Perhaps:

1. Humans rely on the oceans for food/transportation.

2. Human activity often changes sea life/pollutes it.

3. Climate change/global warming affects ocean life.

4. Oceans have inspired great literature.

5. Oceans and their currents affect life on Earth.

6. Life originated in the sea.

From this list of potential topics and subtopics, we can now think about a problematic situation that will invite and engage students' interests.

REFLECTIVE PAUSE

Look again at our suggested topics. What possible problems or issues do you see for human beings related to the oceans? And here let us stipulate that by "problem" I refer to any situation that might be complex, fascinating, intriguing, and possibly mysterious. Recall our research suggesting that whatever possesses "novelty, complexity, uncertainty, and conflict" invites curiosity, exploration, and investigation. (Berlyne, as cited in Kashdan et al., 2004, p. 294). As just noted, we can find such novelty in a work of art, a strange-looking rock, a claim that challenges our assumptions (i.e., no penguins north of the equator), a picture of a fossil, or a pond full of weird-looking things floating on its surface.

Here are some possible problematic, intriguing, novel, and inviting situations involving the oceans:

a. Ocean pollution. This is a very big problem in some areas. For example, at the Great Barrier Reef off Australia's northeast coast we have coral whitening as the result of many factors: over fishing, tourists' boats and their gasoline engines, run off of chemicals from nearby farms and global warming.

b. Problems encountered by explorers like Columbus (threat of being lost and falling over the edge of the flat Earth).

c. Devastation from hurricanes (ships lost at sea and damage to land, e.g., Katrina in New Orleans; Wilma in Florida) and tsunamis (in Southeast Asia after an recent earthquake).

d. Creating living quarters on the sea floor to harvest food and study the effects of living beneath the ocean.

e. Helping endangered species survive in the oceans.

How do we frame a problematic scenario? It needs to have these elements:

1. A complex, fascinating, intriguing problem requiring some kinds of actions.

2. Roles for students to play: "You are . . ." a person/team member faced with this challenge.

3. Opportunities to identify their curiosities and search to find answers.

4. Authentic tasks (problem solving, critical thinking, decision making, and reflection) for them to carry out.

5. Suggestions for what to do with their findings as a culminating, summative assessment.

Using these criteria, let us construct a possible scenario that would be intriguing to students:

Let us select the effects of oceans on coastal areas. We have all witnessed the horrible devastation wrought by the Southeast Asia tsunami and by hurricanes Katrina, Rita, Wilma, and many others. I live in an area of Long Island where a hurricane in 1938 cut a new and permanent channel into Shinnecock Bay. So what might be the problematic area/concern we wish to focus on?

1. The extensive loss of life and damage to property, as in New Orleans.

2. The effectiveness and reliability of early warning systems.

3. Communications outlets to warn populations.

4. Knowledge and effectiveness of political leaders in responding to early warnings.

5. Strain on rescue, relief forces—local, state, and federal.

6. Displacement of peoples from devastated areas.

7. Adequacy of relief supplies in the area.

8. Protecting and/or rebuilding seacoast communities.

This list is, of course, too extensive for third graders, but it is worthwhile to map out several options because the more complexities we see within any one problematic scenario, the better prepared we are to help students investigate and draw reasonable conclusions.

For our purposes, let us focus primarily on the extensive loss of life and property. What do we want students to do about this problem?

1. Identify the problem.

2. Gather information.

3. Suggest possible solutions.

4. Select the best, and explain why these are good solutions.

Now, we can think of roles for our students to play. What would be some likely positions of responsibility they might fulfill?

1. Town planners, mayors

2. Ordinary citizens

3. Rescue workers, leaders of Red Cross

4. State officials, senators, congressmen/women, and governors

5. Students like yourselves

So let's imagine a scenario that puts all of these elements together:

You are members of a state appointed governor's advisory board—composed of students, citizens, local town officials, and rescue personnel. Because of damage to other communities similar to yours along the Gulf, Atlantic, or Pacific coasts of America, the governor has asked you to devise a plan to protect the lives and properties of your coastal community. You must study what was helpful to other communities and make recommendations to the governor to help protect your entire community. Keep in mind that these recommendations should be feasible and based on others' past experience.

Now, how do you think third graders would respond to this? We can immediately notice that this could be a very complex process—of questioning, investigating, deciding, and proposing—so complex that high school students could spend months on it. But would third graders be able to become engaged and find some answers, ones that maybe related to having enough supplies on hand (which they didn't have in New

Orleans), having rescue personnel readily available (some trucks full of supplies were blocked from entering New Orleans), and making sure people were evacuated? Could third graders look at the pictures of all those stranded school buses—tires deep in water—and figure out that you needed to have drivers ready just in case, maybe back up drivers?

Could your third graders meet this challenge? Here's what one third grade teacher said: "This is doable with third graders, given sufficient time, resources like good Web sites and the use of graphic organizers."

We can, of course, also imagine what fourth, fifth, and sixth graders might do with such a challenge. Once we have our problematic scenario, we can proceed to those curricular elements far more familiar to all: objectives, strategies, and assessments.

Our objectives might include the following:

a. Enable students to ask good, appropriate questions and conduct research to find answers. (Here our focus is on the inquiry process itself.)

b. Determine elements of community services useful within an emergency and demonstrate understanding of each.

c. Devise a plan to use appropriate resources using other communities as examples of what to do and not to do.

d. Figure out which responsible officials should execute the plan.

e. Understand how important officials relate to each other (e.g., communicate with each other).

f. Present a workable plan and respond to good questions about it (e.g., "What if . . . ?").

Our strategies can include any of the following:

a. **Planning initiating experiences** that include introducing students to the concept of community (perhaps analyzing school and town communities) and engaging with the problematic scenario. Or engaging students with images of ocean storms and how they can devastate a community.

b. Generating questions and organizing them for research.

c. **Developing core learning experiences** wherein we share important new information with students such as lessons on the nature of communities, comparisons of different communities, discussions on important agencies and how they respond in case of emergency (fire, police, hospitals, rescue forces, army/national guard, and so forth). Or lessons on storms, weather patterns, and

how they develop and discussions about why Katrina was so devastating for New Orleans and surrounding communities.

d. Providing time to conduct research, critically analyze information, and make decisions.

e. Creating a helpful rubric with which to self-assess our final project recommendations.

f. Sharing your plans with fellow students, perhaps fourth graders.

g. Revising plans and final presentations.

h. Planning for **assessments** that should include the final presentations as specified within the problematic scenario; inquiry journals full of assignments, questions, comments, research findings, recommendations, and final reflections.

Now I'd like to mention the idea of "authentic assessment," one clearly articulated by Grant Wiggins. When most of us think of "authentic assessment," we think of tasks that we do in the world beyond schools and perhaps tasks that are intellectually challenging. And this is how Wiggins refers to it, as involving solving problems, applying principles, figuring out what to do and how to do it—all tasks at Levels II and III of the Three Story Intellect (Figure 3.2).

Additionally, Wiggins (1998) suggests that for such assessment to meet the criterion of "authenticity," there must be opportunities for students to practice, rehearse, consult resources, and receive feedback on their ideas (p. 266). This is perfectly reasonable, although not often considered in formal schooling where we take a test, we get a grade, and it goes into the book without opportunity to revise and modify. But in the adult world so often when we have a problem to solve, we get information, devise a set of solutions, and share them with people whom we trust in order to get their input before proceeding to take action.

So too should students have an opportunity to investigate our problem about coastal damage, generate some solutions, put together a plan and, perhaps share the plan with classmates, fourth or fifth graders and adults whose work is related to the problem.

How can we help students obtain feedback on their ideas?

1. Make initial practice presentations a week before the project is due. Videotape these for students to observe their own performances. During these practice sessions classmates should be encouraged to ask good questions that challenge the ideas presented with "What if . . . ?" inquiries. One test of understanding is the ability to answer this question.

2. With students, design a simple rubric they can use to self-assess their own progress.

3. Read students' Inquiry Journals that record their progress in answering their own questions.

4. Use a response form for students to record what their parents say.

5. Other?

CONCLUSION

We shall, of course, revisit how to assess students' learnings later in Chapter 7. But let me emphasize that it is very important at these early planning stages of units to have a good idea of how we wish students to demonstrate the degree and depth of their understandings before we embark upon our unit.

"Provide incongruous situations, novel and/or surprising items; what is novel, surprising, or incongruous depends on the developmental level and particular experiences of the child" (Copple et al., 1984, p. 244).

All of this planning focuses on our identifying that which leads to inquiry and critical thinking: "Provide incongruous situations, novel and/or surprising items; what is novel, surprising, or incongruous depends on the developmental level and particular experiences of the child" (Copple et al., 1984, p. 244).

Problem solving is a key to expanding children's cognitive abilities. "Giving children problems which are meaningful, important, and challenging is the first consideration. Asking them for their ideas and acknowledging these enhances the children's sense of competence and gives them the opportunity to see how enjoyable it is to generate ideas" (p. 246) and, I might add, questions.

Thus, creating and using problematic scenarios is an important way to engage students' interests as well as develop their intellectual abilities.

SAMPLE PROBLEMATIC SCENARIOS

Grade K–1

You are a space traveler from a distant planet. You are on a mission to explore all living things on the planet Earth. Your assignment is to investigate the characteristics of living beings of your choice and to identify

nonliving things you find here. You are to identify the basic needs necessary for growth and survival and compare how these needs are different from those of nonliving things. You will need to learn about living things, their habitats, and basic needs in a cooperatively made book or picture for observation.

Grade 1 (Special Education)

You are a meteorologist looking for a job. NBC wants to hire you but they need proof that you know and understand the water cycle. They need to see written records of your observations. They also need predictions on experiments and results of them, too. Finally, you will receive a $1,000 salary raise if you can draw a diagram of the water cycle and label it.

Grade 2

You are a member of the principal's advisory committee on redesigning the school playground. Examine what we have now: what kinds of play equipment exists on the playground currently. Determine what you think we need. How will you gather information and from whom? Then plan out what would be an ideal playground. Make sketches of your plan. Figure out how you would present this plan to the principal and parents. Be prepared to tell why you think each piece of equipment ought to be in a playground (Ann Marie Pantano and Brian Mackoul, Upper Montclair, New Jersey, as cited in Barell, 1995, p. 28).

Grade 2

Hurricane Katrina destroyed the city of New Orleans. Your town was chosen as a model community to help rebuild. Think about how your town and other towns meet the needs of its citizens. Come up with a plan to rebuild New Orleans as a working community. Your plan will be presented to the town council for approval.

You can

- make a poster;
- make a model;
- make a map;
- make a list;
- make a brochure;
- do a skit.

You should show knowledge of

- what a community is;

- the needs of a community;
- people working together—interdependence. (Kelly Toll Guzman, Denise Poole, and Christine Gill of Joseph Sharp Elementary School, Cherry Hill, New Jersey)

Grade 3

You are responsible for finding a way (or ways) to stop the destruction of the ocean so that the animal or plant life that you have chosen and researched can remain a part of the ocean community. You must find a way to show that your method of saving the ocean will not only help the species that you have chosen, but will also help to preserve all of the living and nonliving things that the species is dependent on, and all of the things that are a part of the ocean community that depend on it—interdependence (Cutrupi, personal communication 2000).

Grades 5/6

"You are an earth scientist who has been hired by a publishing company to create an ABC book on landforms. They are sending you to different places around the world to research and investigate the formation of landforms both continental and oceanic. When you return you design the book to educate future fifth graders about the natural processes of Earth.

You will keep a journal of all of your ideas for each letter of the alphabet. In this journal you will put information you already know, what you are learning along the way and questions that you are still curious about.

By the end of all your experiences you will have enough ideas and have completed all research to create an artistic alphabet book filled with knowledge about the formation of landforms" (Kim Nordin, Rosewood Elementary School, South Carolina, Grade 5).

Kim (personal communication, June, 2007) notes, "We found the students very engaged in this planner [unit] because they knew *from day one what they were to accomplish by the end of the planner*. [Italics added] This gave them focus, drive and excitement. It really allowed for them to be inquirers as they questioned and researched landforms. Also, by allowing them to create their own rubric for the book they felt like they had ownership in their project.

Grades 5/6

For a unit on Culture and Geology of the Appalachian Region, you are a young economist studying various regions of the country. You discover that people in Appalachia live under very difficult economic conditions.

You have a number of questions, among which is Why do people continue to live there if economic conditions are so difficult? How did living conditions become so harsh?

What other questions need you to ask about these living situations as you work toward developing a plan for economic renewal. You must consider several alternatives and support your choices with good reasons and examples from the economic development of other communities (adapted from Barell, 2007a, p. 63).

Grade 6

You are a technologist recently called into a town near the slopes of Mt. St. Helens. Geologists predict that another pyroclastic flow (similar to that of 1980) will occur sometime in the near future. Such a natural disaster jeopardizes the lives of thousands of people. Develop and build a protective device to offset the power of this phenomenon thereby saving the lives and protecting the property of the population.

Variations on the "You are." scenario involve making claims:

> Today's students need to prepare for the institution of a draft—for young men and women of high school age. (I presented this as a problematic scenario to a group of fifth graders studying the U.S. Constitution and there ensued vigorous debate about what they thought they knew about the Constitution, their rights and responsibilities as well as those of the Executive and Legislative Branches. I introduced this by stating that the principal had received a letter from the president stating his new policy.

Suggesting a "What if . . ." scenario

What if the governor of your state says your town and others are becoming too crowded. He is asking you to find a suitable location for a new town and wants to know what kinds of community services we need and why and how you might improve them. (I presented this to second graders studying communities and used it as a formative assessment. What was interesting was that in two different grades students seemed to focus much of their ideas on one service—e.g., police or hospitals.)

PRACTICAL OPPORTUNITIES

1. Select a unit you have already taught and create a problematic scenario for it.

2. Select a unit you will teach in the future and work through the webbing, selecting, and designing problematic scenario process previously identified.

3. Which of your previous units have contained elements that foster curiosity and that challenge students to inquire and think? Consider Figure 4.1.

4. What objects/experiences/persons in your experience have already fostered your and your students' inquisitiveness?

5. Consider variations on the problematic scenario:

   a. Making claims that arouse curiosity—"The oceans can never recover from the damage we've done to them."

   b. Using "What if?" wonderings: "What if everybody in the United States had to have an ID card with a computer chip inside that had information about residence, health, employment, and parking tickets?"

   c. For more such possibilities see *Problem-Based Learning—An Inquiry Approach*, Barell, 2007a.