CTE6

STAFF DEVELOPMENT TRAINING FOR TEACHER TRAINERS

Resource Packet

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# STAFF DEVELOPMENT MANUAL

## INFUSION PROGRAM

**INFUSING THE TEACHING OF CRITICAL AND CREATIVE THINKING INTO CONTENT INSTRUCTION**

**STAFF DEVELOPMENT MANUAL**

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CHAPTER 1

GOALS OF THE INFUSION STAFF DEVELOPMENT PROGRAM

Infusing Critical and Creative Thinking into Content Instruction (ICCT), a lesson design program, demonstrates how we can blend the teaching of specific thinking skills and processes with effective content instruction. This is accomplished through lessons which involve:

- engaging students in explicit organized thinking about a topic in the regular curriculum,
- facilitating their reflective understanding of such skillful thinking,
- giving students additional practice in deliberately using this kind of thinking so that they engage in it when appropriate without prompting.

Because standard text books do not commonly offer lessons for explicit instruction in thinking skills and processes, teachers must restructure their lessons to accomplish the goals of infusion.

ICCT emphasizes a broad spectrum of thinking skills and processes that are important across the curriculum. The thinking skills fall into the three main categories of thinking: understanding and retaining ideas, generating original ideas, and assessing the reasonableness of ideas. The more complex, specialized processes emphasized in ICCT are decision making and problem solving. When we engage in these processes thoughtfully, they blend these three types of thinking.

Not all instructional projects that use the term "infusion" promote instruction in the same range of thinking skills and processes or instruction that involves the same components of lesson design. For example, some programs that promote teaching thinking in the content areas emphasize only a small range of skills, such as skills of understanding and retention. Typically, such programs do not teach students how to generate original ideas (creative thinking) or to assess their reasonableness (critical thinking).

Similarly, some projects that promote teaching thinking in the content areas primarily stress the use of instructional methods like asking "higher order questions". While using these methods encourage students' thought, they typically do not teach students reflective ways to reorganize their thinking. Such approaches give little or no attention to key components of infusion lessons: teaching thinking skills and processes directly, engaging students in metacognitive reflection, and teaching directly for the transfer of thinking skills to a wide range of appropriate contexts.

Because infusion requires restructuring content area lessons, infusion training is staff-development intensive. This does not mean, however, that teachers are trained to teach pre-existent lessons from a ready-made packet of materials. Rather, teachers learn how to design infused lessons themselves and to teach them to their students. Staff-development projects which have infusion as their goal utilize a basic structure to achieve this goal: A combination of group workshops and individualized coaching sessions. Within this structure, trainers have considerable latitude in scheduling and organizing in-service sessions. The six sub-goals of infusion staff-development projects provide that each participant shall:

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• understand what skillful thinking involves
• understand strategies that can be used to teach thinking skills and processes in the content areas
• gain facility in using the skills that are being taught
• identify a range of appropriate contexts in what they teach for lessons infusing these thinking skills and processes.
• develop infused lessons in their instructional areas
• use appropriate instructional strategies in the classroom to promote skillful thinking

Understanding what skillful thinking involves means that participants have a clear understanding of the three domains of thinking (understanding, creative thinking, and critical thinking), as well as the two complex processes in which these forms of thinking manifest themselves (decision making and problem solving). They should be able to identify the various core skills and attitudes in these domains and know what makes each kind of thinking skillful.

Key strategies for teaching these skills in the content areas involve the use of verbal and graphic organizers, types of metacognitive questions that prompt students’ reflection on their thinking, and supplementary examples for both near and far transfer so that students can gain more practice leading to their internalizing the thinking skills being taught. Additional effective and well researched classroom strategies, like collaborative learning, are used in infused lessons. In ICCT these strategies are woven together into an integrated instructional plan for the teaching of thinking in the content areas, blending content instruction with the teaching of thinking to yield both improvements in thinking and enhanced content learning.

Participants in infusion projects gain facility in their own thinking skills through guided reflection about the way they think in their own lives or professional work. Teachers’ practice of good thinking enhances teaching good thinking to students.

As participants are introduced to individual thinking skills taught in ICCT, they locate contexts in their own teaching in which these skills can be infused. Context suggestions generated by all of the participants in an infusion project are made available to each teacher.

Through coaching in lesson design and supervised classroom instruction that participants in infusion training gain facility in designing and teaching infused lessons. The main goal of ICCT is that it become "second nature" for teachers to teach thinking in the content areas.

It is the role of the trainer to provide the support necessary to help teachers involved in infusion projects achieve these goals. The lesson design handbooks for elementary and secondary teachers (Infusing Critical and Creative Thinking into Content Instruction) contain a basic set of materials to be used in the kinds of staff development projects we describe in this manual. The primary purpose of this manual is to furnish strategies, additional materials, and suggestions to assist trainers as they set up and conduct such staff development programs.
CHAPTER 2

TYPES OF STAFF DEVELOPMENT TRAINING PROGRAMS FOR INFUSION PROJECTS

Scope, Duration, and Goals
Infusion training requires long-term staff development. This, in turn, involves group workshops and supervised practice. Short-term presentations and workshops are, at best, introductory awareness sessions about infusion and are no substitute for sustained training.

Depending on the number of skills and processes covered, effective staff-development projects in infusion range from one to five years. The in-service plan endorsed and practiced for use with ICCT is organized into modules. All of the basic components of an infusion lesson are emphasized in each module. Modules differ in the skills or processes that are the focus of training. The most demonstration- and training-intensive module is the introductory one.

Each module involves a combination of group workshops and individualized coaching sessions about lesson-design/classroom practice. Each module includes:

- location of contexts for infusion.
- The goals of the individualized coaching sessions are to help teachers practice:
- designing infused lessons
- teaching infused lessons

Typically, at least two weeks should elapse between the group workshops and the individualized coaching sessions.

Structure of Group Workshops
Each segment of a group workshops includes a demonstration lesson on a specific form of skillful thinking in a curricular context to show how instruction in that skill can be infused. Prior to the lesson there should be some discussion of the thinking skill and why it is important to teach it. In addition, the lesson demonstration also emphasizes the use of key strategies in designing and teaching infused lessons. Hence, each skill segment in the group workshops includes:

- Discussion of the skill being taught
- A lesson demonstration in which instruction in the skill is infused into instruction in some selected topic in one of the content areas
- Discussion of one or more lesson design feature and/or instructional strategy for teaching the skill

Participants should be given written copies of the lesson demonstrated together with any graphic organizers used filled in with student responses.

In addition, at least two other lessons at different grade levels and in different subject areas should be described, but not demonstrated. Finally, participants should be given the opportunity to apply the ideas introduced by locating contexts in the

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STAFF DEVELOPMENT MANUAL

INFUSION PROGRAM

Curriculum in which similar lessons can be developed. It is desirable to assign participants into "job alike" groupings when they do this.

Each of these workshop segment should be conducted using visuals (e.g. transparencies) and handouts (e.g. blank graphic organizers that participants work with). They should also be structured so that participants work together in small collaborative learning groups and then share their results with the whole group. Support materials for use in the workshops (handouts, transparency masters, etc.) are included in this manual.

Here are two sample schedules describing workshop segments on different thinking skills/processes. The first one is an opening segment of an infusion staff development project. The second is one of the subsequent segments.

### Introduction:

**What kinds of thinking are important to teach?** Is teaching thinking for all students? Are its results demonstrable? How does infusion contrast with other approaches to teaching thinking?

### Lesson Demonstration:

**Lesson on decision making:** (E.g., Truman's Decision to Bomb Hiroshima, Alternative Energy Sources, Mr. Arable and the Runt Pig from *Charlotte's Web*)

### Commentary:

Teaching thinking explicitly in the content areas Using verbal and graphic organizers in infused lessons

### Additional lesson examples on the same thinking process

### Group Work:

Finding contexts in your teaching for similar lessons

---

Notice how the lesson demonstration in these workshop segments serves a double purpose. It demonstrates how a thinking process (skillful decision making) or thinking skill (skillful causal explanation) can be infused into a specific curricular context. In addition, it illustrates how one of the basic lesson-design strategies for infusion lessons functions. In the case of the decision making demonstration, this is the use of prompting questions and a graphic organizer to guide an explicit thinking activity. In the case of causal explanation, it is the use of strategies to prompt students' thinking about their own thinking. These strategies are then elaborated in the lesson commentary.

The additional lesson examples on the same skill that you describe after the commentary should be chosen to meet the needs and interests the participants. In general, try for as broad a spread across the curriculum as you can for a K-12 audience. This approach can be adapted for more specialized audiences (e.g. an audience of K-12 science teachers). Comments and displays from a teacher who has actually developed his or her own infusion lessons on the same skill can enrich this part of the workshop presentation.

If at all possible, teachers should have an opportunity to use time during the
workshop to actually begin to design an infused lesson. For example, each participants could take one lesson idea and develop one or two of the core activities in the lesson in some detail (e.g. the lesson introduction and the main critical thinking activity). This, too, is best accomplished in small collaborative learning groups. Lesson design organizers and support materials are included in Chapter 4.

A modified version of a workshop segment can be used for awareness presentations at conferences, preliminary faculty meetings, etc. These presentations usually involve one or two lesson demonstrations that illustrate key points about infusion. The minimum amount of time we have found effective for such sessions is 1 1/4 hours. It is important that audiences at such sessions know that these are awareness presentations only; they are no substitutes for lesson-design workshops.

Implementation Training

After the group workshops are completed, participants should be asked to design lessons in their own fields and grade levels on one or two of the skills demonstrated in the workshops. Teachers should select lessons which can be taught during a period of two or three weeks after the workshops. A simple lesson-design form is provided in Chapter 6.

There are two goals of implementation training:

- Each participant has one well-crafted infused lesson on each skill covered in the workshops
- Each participant teaches the infused lessons that has been designed using strategies introduced in the workshops.

Implementation sessions for lesson design are usually conducted on a one-to-one basis or with pairs of teachers. Participants should produce a written lesson design for each of the skills being considered. Coaches then work with the participants to refine lessons. Usually a one-half hour discussion is sufficient. Trainers can meet with 10-12 teachers during the same school day. A substitute teacher should be provided while trainers meet with these teachers.

Whenever possible, coaches should also observe infusion lessons in the classroom and debrief with a teacher after the lesson has been conducted. If direct classroom observation is not possible, videotaping of the lesson can provide a rich basis for debriefing. In this case, the teacher should be asked to keep a log for debriefing purposes.

Coaching sessions of these sorts should be repeated until lessons on all of the skills covered in the workshops have been developed and taught.

During the coaching process, trainers should practice questioning strategies that focus on how the key ingredients in the lesson are structured and how they are interwoven with the content. Suggestions can be made about how to enhance the design of the lessons. In ICCT staff-development programs four key points are examined in discussing each lesson:

- active involvement in the thinking process
- explicit instruction in the skill
- metacognitive strategies
- transfer.

Some schools with infusion projects phase out out-of-district consultants as implementation coaches during or after the first year, replacing them with a system of peer coaching. In this case coaches from the district serve as apprentices during the initial stages of the project and then, when certified by the consultant, take over the coaching directly.

Scheduling and Maintenance

Teachers have little extra time to devote to restructuring lessons even in schools that provide lesson-development and design
time during the school day. Infusion projects commonly include two modules of training per year, one in the fall and winter, the second in the winter and spring. (In many cases, only one module per academic year may be all a school or school district can sustain.) This means that three to six thinking skills or processes per year is a reasonable goal of standard infusion training programs. Repeating this process for one to four additional years will provide teachers in a school or school district with a repertoire of well-crafted infused lessons that can be used in subsequent years.

Depending on the number of trainers available to work in a school or district and the financial support available for the participants (substitutes, etc.), large numbers of teachers can be involved in these projects at the same time. It is our recommendation that, in projects in which a number of trainers are working together, the trainers should focus on the same skills at the same time so that collaboration between training groups can occur.

After each module is completed, the district may assemble a collection of infused lessons. This resource book provides a record of the results of the training and examples for other teachers to use as models for the development of similar lessons (e.g., new teachers entering the district).
LESSON DESIGN MODULE FOR STAFF DEVELOPMENT PROGRAMS ON INFUSION

Group Workshop
Group sessions led by certified presenter on infusing up to four specific skills into content instruction

Lesson Design
Participants design lessons on the skills introduced in the group workshop

Coaching
One-on-one session between coach and participants on the design of their lessons

Instruction
Participants teach their lessons with optional observation by coach/peers, or video taping

Debriefing
Participants debrief with peers or coach

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Infusing Critical and Creative Thinking into Content Instruction: A Lesson Design Workshop

Module One

SESSION I: Three Hours
WHAT IS AN INFUSION LESSONS?
Introduction:
What kinds of thinking are important to teach? Is teaching thinking for all students? Are its results demonstrable? How does infusion contrast with other approaches to teaching thinking?

Lesson Demonstration:
Lesson on decision making

Commentary:
Teaching thinking explicitly in the content areas.
Three key components of infused critical thinking lessons: Explicit organized thinking, metacognition, and teaching for transfer

Additional Lesson Examples on the Same Thinking Process

Group Activity:
Find contexts in your teaching for similar lessons.

SESSION II: Three Hours
HOW INFUSION LESSONS TEACH THINKING AND ENHANCE CONTENT LEARNING

Introduction:
Teaching thinking skills as well as complex processes. Teaching for thinking and the teaching of thinking in content area instruction.

Lesson Demonstration:
Lesson on comparing and contrasting

Commentary:
Using special methods to enhance thinking.
Structured questioning to prompt organized thinking.
Using verbal and graphic organizers in infused lessons.

Additional Lesson Examples on the Same Thinking Skill

Group Activity:
Find contexts in your teaching for similar lessons
Choose one of your decision making or comparing and contrasting lesson contexts and sketch some ideas about how you might develop it into a full infusion lesson

IMPLEMENTATION ASSIGNMENT: Over the next three weeks
TEACHING INFUSION LESSONS
Design and teach two infused critical thinking lessons, one on decision making and the other on comparing and contrasting.
Module Two

SESSION I: Three Hours
VARIATIONS ON THE DIRECT TEACHING OF THINKING SKILLS

Introduction:
Critical thinking as assessing the reasonableness of ideas in order to make well-founded judgments. Teaching to make good thinking stick with students.

Lesson Demonstration:
Lesson on determining the reliability of a source of information

Commentary:
Direct and inductive strategies in infused critical thinking lessons. Strategies to promote metacognition.

Additional lesson examples on the same skill.

Group Activity:
Find contexts in your teaching for similar lessons.

SESSION II: Three Hours
TEACHING THINKING SKILLS ACROSS THE CURRICULUM

Introduction:
Critical thinking skills of inference. The need to reinforce instruction in specific thinking skills across the curriculum.

Lesson demonstrations:
Lessons on predicting consequences and on causal explanation

Commentary:
Choosing good content topics for the robust infusion of critical thinking across the curriculum.
Types of transfer and reinforcement activities.

Additional lesson examples on the same skill.

Group Activity:
Find contexts in your teaching for similar lessons.
Choose one of your reliability of sources, causal explanation, or prediction lesson contexts and sketch some ideas about how you might develop it into a full infusion lesson.

IMPLEMENTATION ASSIGNMENT: Over the next three weeks
TEACHING INFUSION LESSONS
Design and teach two infusion lessons, one on determining the reliability of a source, the other on either causal explanation or prediction.
Chapter 3
Building an Understanding of Skillful Thinking

What to Communicate to Teachers about Thinking

Strictly speaking, infusion, as a technique for teaching thinking in the content areas, is not limited to any specific set of thinking skills and/or thinking processes. Whatever kind of thinking is important in a given context can be infused. However, ICCT recommends that a whole range of core skills should be addressed across disciplines and across grade levels in K-12 and college instruction. These include the three basic thinking domains (understanding and retention, creative thinking, and critical thinking) and two domains of important complex thinking processes (decision making and problem solving).

ICCT goes beyond simply asking students to do certain kinds of thinking (like decision making). When this is all that is asked such thinking may occur in incomplete or uninformed ways. ICCT promotes thinking systematically and skillfully. This involves knowing what we should attend to in our thinking, how carefully we should consider it, and what standards we use in making critical judgments. "Thinking maps" for structured questioning and specialized graphic organizers display these aspects of skillfulness in thinking.

In training teachers in ICCT it is therefore necessary to communicate two things:

- the domain of thinking skills and processes to be infused into lessons
- what makes these forms of thinking skillful.

Display and discussion of the diagram representing the "Map of the Thinking Domain" clarifies the thinking skills and processes addressed in ICCT. Communicating what makes these forms of thinking skillful can best be accomplished by demonstrating lessons which infuse each of these skills and processes. During such demonstrations the corresponding thinking maps can be displayed and explained.

How to Communicate About Thinking and What Makes it Skillful

Generally, teachers involved in infusion projects must understand certain basic ideas about thinking in order to be effective in developing and teaching infused lessons. In ICCT staff development programs these ideas are communicated in three basic ways: through direct presentations at group workshops, supplemented by various graphic transparencies and handouts; through active demonstrations at these workshops; and through supplemental reading material contained in their packets.

Transparency masters that can be used in direct workshop presentations are included in this chapter: (1) the domain of thinking and (2) some important skills of good thinking, (3) various thinking maps, and (4) various graphic organizers.

Also included is a transparency master with five quotations culled from the media. Statements like these can be used in an active demonstration to engage participants in various forms of thinking which the trainer helps the participants categorize. Participants are shown the quotations, told what they are, and asked to identify what questions would they raise in order to decide whether to accept them. Typically, responses fall into four categories: questions of clarification, of source, about what evidence supports these claims, and, finally, whether and why the information is important. These are then identified as the
types of questions good thinkers ask. Answering these questions well requires skillful thinking that falls into the basic categories of thinking outlined on the map of the thinking domain.

A second activity puts workshop participants in the position of reflecting on the way they engage in the types of thinking taught in ICCT and articulating what makes this kind of thinking skillful. For example, participants can be asked to identify examples in which they engage in a certain type of thinking (e.g., decision making) which didn't turn out well. They are then asked to discuss with their neighbor what went wrong and what they could do to improve their thinking. Pooling the results and organizing it yields a "map" of better thinking of that sort.

This activity provides an example of how a group can develop a map of the skillfulness of a type of thinking. This manual includes transparency masters of maps of various kinds of thinking (e.g., decision making). These can be compared to what the participants come up with, or used to summarize their results.

These activities can be presented in workshops to serve double duty: they build teachers' awareness of what the thinking domain involves, and they model activities that can be done in classrooms with students.

Reading material about thinking is contained in the lesson design handbook. Each section on a different thinking skill or thinking process starts with a discussion of why it is important to engage in the type of thinking discussed skillfully and what is involved in so doing.
MAP OF THE THINKING DOMAIN

CLARIFICATION AND UNDERSTANDING
GOAL: Deep Understanding and Accurate Recall
CORE SKILLS:
1. Analyzing Ideas
2. Clarifying Ideas
3. Establishing Relationships
4. Drawing Conclusions
5. Clarifying Assumptions

CREATIVE THINKING
GOAL: Original Product
CORE SKILLS:
1. Generating Ideas
2. Generating Alternative Possibilities
3. Multiplicity of Ideas (Flexibility)
4. Novelty of Ideas (Originality)
5. Elaboration

CRITICAL THINKING
GOAL: Critical Judgments
CORE SKILLS:
1. Assessing Basic Information
2. Assessing Consistency, Integrity, and Validity of Sources
3. Evaluating the Evidence
4. Evaluating the Argument
5. Evaluating the Reasoning

DECISION MAKING
GOAL: Well-founded decisions
BASIC STRATEGY:
- Consider options, predict consequences, and choose the best option
SKILLS:
- Skills at generating ideas, clarifying ideas, and assessing the reasonableness of ideas

PROBLEM SOLVING
GOAL: Best Solution
BASIC STRATEGY:
- Consider possible solutions, predict consequences, and choose the best solution
SKILLS:
- Skills at generating ideas, clarifying ideas, and assessing the reasonableness of ideas
Three Types of Important Thinking Skills

I Generating Ideas
1. Alternative Possibilities
   A. Multiplicity of Ideas
   B. Varied Ideas
   C. New Ideas
   D. Detailed Ideas
2. Combining Ideas
   A. Analogy/Metaphor

II Clarifying Ideas
1. Analyzing Ideas
   A. Comparing/Contrasting
   B. Classification/Definition
   C. Parts/Whole Relationship
   D. Sequencing
2. Analyzing Arguments
   A. Finding Conclusions/Reasons
   B. Uncovering Assumptions

III Assessing the Reasonableness of Ideas
1. Support of Basic Information
   A. Determining Accurate Observation
   B. Determining Reliable Secondary Sources
2. Inference
   A. Use of Evidence
      1. Causal Explanation
      2. Prediction
      3. Generalization
      4. Reasoning by Analogy
   B. Deduction
      1. Conditional Reasoning (If...then...)

Two Types of Important Thinking Processes

1. Decision Making
2. Problem Solving
SKILLFUL DECISION MAKING

1. What makes a decision necessary?

2. What are my options?

3. What information is there about the consequences of each option?

4. How important are the consequences?

5. Which option is the best in the light of the consequences?

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## Skillful Decision Making

### Options
What can I do?

### Option Considered

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<th>Support</th>
<th>Value</th>
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<td>What will happen if you take this option?</td>
<td>Why do you think each consequence will occur?</td>
<td>How important is the consequence? Why?</td>
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CHOOSING

OPTIONS
What can I do?

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YOUR OPTION

RESULTS
What will happen?

THINK ABOUT THE PROS AND CONS

CHOICE
Is this a good thing to do?

Why?

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## DECISION MAKING MATRIX

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**UNANSWERED QUESTIONS:**

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OPEN
COMPARE AND CONTRAST

1. How are they similar?

2. How are they different?

3. What similarities and differences seem significant?

4. What categories or patterns do you see in the significant similarities and differences?

5. What interpretation or conclusion is suggested by the significant similarities and differences?
FOCUSED COMPARE AND CONTRAST

1. What kinds of similarities and differences are significant to the purpose of the comparison and contrast?

2. What similarities fall into these categories?

3. What differences fall into these categories?

4. What patterns of similarities and differences are revealed?

5. What conclusion or interpretation is suggested by the comparison and contrast that is significant to its purpose?
FOCUSED COMPARE AND CONTRAST

<table>
<thead>
<tr>
<th>PURPOSE:</th>
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<tr>
<th>FACTORS TO CONSIDER:</th>
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| FACTORS CONSIDERED IN THIS ACTIVITY: | HOW ALIKE? | |
|---|---|

<table>
<thead>
<tr>
<th>HOW DIFFERENT?</th>
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<tr>
<th>CONCLUSION OR INTERPRETATION:</th>
</tr>
</thead>
</table>

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SKILLFUL CAUSAL EXPLANATION

1. What are possible causes of the event in question?

2. What could you find that would count for or against the likelihood of these possibilities?

3. What evidence do you already have, or have you gathered, that is relevant to determining what caused the event?

4. Which possibility is rendered most likely based on the evidence?
CAUSAL EXPLANATION
POSSIBLE EVIDENCE  ACTUAL EVIDENCE

POSSIBLE CAUSE

IS THE POSSIBLE CAUSE LIKELY, UNLIKELY, OR UNCERTAIN?
SKILLFUL PREDICTION

1. What things might happen as the result of a particular event or general condition?

2. What sort of evidence could you get now that would make these possibilities likely or unlikely: e.g., from past experience or from reliable sources?

3. What evidence do you have that is relevant to the likelihood of what will happen?

4. How likely are these possibilities based on this evidence?
EVALUATING THE SIGNIFICANCE AND LIKELIHOOD OF THE CONSEQUENCES OF OPTIONS

1. What consequences might result from a specific decision?

2. Does each consequence
   a. count for or against the decision?
   b. rank as important?

3. How likely is the consequence?
   a. Is there evidence that counts for or against the likelihood of the consequence?
   d. Based on all the evidence, is the consequence likely, unlikely, or is its likelihood uncertain?

4. Is the decision advisable in light of the significance and likelihood of the consequences?
### Predicting Consequences of Options

<table>
<thead>
<tr>
<th>VALUE</th>
<th>CONSEQUENCES</th>
<th>EVIDENCE</th>
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<th>OPTION</th>
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<td>LIKELIHOOD</td>
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<td>? UNCERTAIN</td>
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EVALUATING THE RELIABILITY OF SOURCES SKILLFULLY

1. What is the source of the information being considered?

2. List the factors present that are relevant to the reliability of the source in the following categories:
   Published?
   Date?
   Reputation of publication?
   Kind of publication (e.g. report, fiction)?
   Author?
   Expertise?
   Bias or distorting point of view?
   Special interest?
   Primary or secondary?
   If secondary, the reliability of any other sources the information is derived from?
   If primary, other relevant factors, e.g. equipment used?
   Corroboration/confirmation?

3. Weigh the factors present and make a judgment of reliability based on them.
RELIABILITY OF SOURCES

1. To find out whether a source is reliable, ask whether the source:

   Knows the subject?
   Found out from someone else who is reliable?
   Found out by careful investigation?
   Has a reason for wanting you to believe him or her?
   Is known and trusted by others?

2. Also ask whether anyone else thinks the same thing.

For use in the primary grades.

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DETERMINING THE ACCURACY
OF AN OBSERVATION

1. Which of the following features of the observer, observation, and report are present in this case?

Observer:
- Background
- Qualifications
- Usual reliability
- Free of bias?
- State of mind?
- Physical ability to observe (eyesight, etc.)?
- Capacity to observe (proximity, direction, free of distraction)?
- Expectations/point of view
- Vested interest in having audience believe report?

Conduct of the Observation
- Frequency?
- Equipment:
  - Strength or accuracy?
- Condition
- How operated?
- Date and location?
- Replicated?

Report
- How soon after observation?
- Details (drawings, photographs, graphs)?
- Language and findings expressed objectively?

Corroboration:
- By others?
- By me?

2. When you weigh these factors how reliable would you judge the observation to be?
### Questions about the Reliability of a Source of Information

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<th>Questions</th>
<th>Types of Questions</th>
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DETERMINING THE RELIABILITY OF SOURCES

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SOURCE

RELIABLE, UNRELIABLE, OR UNCERTAIN?
THINKING ABOUT THINKING SKILLFULLY

1. What type of thinking did you engage in?

2. How did you do the thinking?

3. Was that an effective way to do this thinking? Why or why not? If not, what can you do to improve this way of thinking?

4. How will you do this kind of thinking next time it is needed?
### METACOGNITION LOG

<table>
<thead>
<tr>
<th>WHAT WAS THE THINKING SKILL YOU USED IN THIS LESSON?</th>
<th>WHAT QUESTIONS OR DIRECTIONS PROMPTED YOU TO ENGAGE IN THIS THINKING IN THE LESSON?</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOW DID YOU CARRY OUT THIS THINKING? (What steps did you go through in your thinking as you did the lesson?)</td>
<td></td>
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<tr>
<td>DESCRIBE HOW THIS WAY OF THINKING COMPARES WITH OTHER WAYS YOU MIGHT HAVE THOUGHT ABOUT THE ISSUES IN THE LESSON? WHICH DO YOU PREFER AND WHY?</td>
<td>IF YOU USE THIS THINKING IN ANOTHER SITUATION, HOW WOULD YOU PLAN TO DO IT? PICK A SPECIFIC EXAMPLE AND DESCRIBE WHAT YOU WOULD THINK ABOUT IN SOME DETAIL.</td>
</tr>
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## METACOGNITIVE QUESTIONS

### AWARE METACOGNITION (Naming thinking)

<table>
<thead>
<tr>
<th>Question</th>
<th>Question</th>
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<tbody>
<tr>
<td>What was the thinking skill or process that you used in this lesson?</td>
<td>What is another name for the thinking skill or process that you used in this lesson?</td>
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</table>

### STRATEGIC METACOGNITION (Using the thinking strategy)

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<tr>
<th>Question</th>
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<tbody>
<tr>
<td>How did you carry out this thinking?</td>
<td>How did using the graphic organizer help you do this type of thinking?</td>
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<td>(What steps did you go through in your thinking as you did the lesson?)</td>
<td>How did discussing your ideas with your partner of group help you do this type of thinking?</td>
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<tr>
<td>What questions or directions prompted you to engage in this thinking in the lesson?</td>
<td>How did writing out your ideas help you do this type of thinking?</td>
</tr>
<tr>
<td>How did using the verbal map help you do this type of thinking?</td>
<td>Draw another diagram that shows this kind of thinking?</td>
</tr>
</tbody>
</table>

### REFLECTIVE METACOGNITION (Evaluating, comparing, and planning thinking)

**Evaluative Metacognition**

When this kind of thinking didn't work well for you in the past, what might you have done differently?

- How did doing this type of thinking help you understand what you were learning differently?
- How does using this kind of thinking help you organize your thoughts before writing?
- Why is it important to do this kind of thinking?
- Why is it important to think about (a step in the thinking skill or process-options, consequences, significance, likelihood, causes, evidence, expertise, conditions of an observation, corroboration, reasons, conclusions, assumptions, characteristics, etc.)?

**Comparative Metacognition**

Describe how this way of thinking compares with other ways you might have thought about the issues in the lesson?

- Which to you prefer? Why?
- In what situations would this way of doing this kind of thinking work better than others?
- Is there a clearer way to do this kind of thinking?
- How does this kind of thinking affect the way you listen to or read about this idea in comparison to other ways that you listen or read?

**Prospective Metacognition**

If you use this thinking in another situation, how would you plan to do it? Pick a specific example and describe in some detail what you would think about.

- In what situations might you not use this way of thinking?
- How would you decide whether to use this strategy?
- Write out a plan for doing this kind of thinking that someone else can follow?
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FIVE QUOTES

1. William Casey said, on his death bed, that the CIA directed the Iran-Contra operation from the start.

2. The ozone layer is being depleted by chemicals in spray cans.

3. The Russians are really not sincere about reducing the threat of nuclear war.

4. Marijuana contains more carcinogenic agents than tobacco.

5. By 1991 100,000,000 people will be infected by the AIDS virus.
Chapter 4

Building an Understanding of How to Teach Skillful Thinking in the Content Areas

What Teachers Should Learn About the Design of Infused Lessons

Infusing the teaching of critical and creative thinking in content area instruction involves blending direct instruction in skillful thinking with content learning. This requires a structure for lesson design to help students internalize habits of thought that make their thinking skillful. This involves three basic components:

- engaging students in active thinking structured by explicit organizing and focussing prompts
- helping students reflect about their thinking
- giving students a variety of opportunities to practice these habits of thought while the teacher gradually phases out of the process.

Teaching skillful thinking this way is enhanced by the use of special teaching methodologies (like the use of collaborative learning) which create an overall atmosphere for thinking in the classroom.

Choosing contexts for infusion lessons in which there is a robust blending of the thinking and the content enhances content learning dramatically.

Infusion contrasts, on the one hand, with stand-alone programs which promote direct instruction in thinking skillfully outside the curriculum, usually via pre-packaged or stand-alone programs, and, on the other hand, with the use of various methods that do create opportunities for thinking, but don't yet offer direct instruction in skillful thinking. Showing teachers the "arrows" diagram and explaining these contrasts can communicate the relationship between infusion and these other approaches.

Teachers being trained in infusion should learn the basic features of lesson design and should apply them to their own instruction by designing lessons which incorporate them.

How Lesson Design Features Can Be Communicated to Teachers

ICCT communicates these features to teachers in three ways. The first is through direct presentations, the second is through active lesson demonstrations, and the third is through engaging teachers in lesson design themselves.

The use of lesson demonstrations is the centerpiece of this approach. Lesson which clearly incorporate each of these features should be chosen for demonstrations in the workshop components of each module. It is then the choice of the presenter as to whether the demonstration is followed by a commentary on this overall three-pronged lesson structure or of one of the basic components.

It is usually helpful to start a staff development project with lesson demonstrations which clearly illustrate the way the three components weave together in a well-structured infusion lesson. The "Three Components" transparency can be used to point out these components in the commentary on the lesson. Then each of the three can be stressed individually in subsequent demonstrations. For example, a lesson on decision-making in which the main activity is clearly structured using the verbal map and graphic organizer for decision making can be used to illustrate the first component. A lesson with an elaborated empha-
sis on students' reflection on their own thinking, accompanied by the use of the metacognition log, can be used to illustrate various metacognitive techniques. And a lesson in which there is an elaborated series of follow-up examples can be used to illustrate teaching for transfer. This can be accompanied by the internalization graphic. Transparency masters are included in this chapter to serve each of these purposes.

**Choosing Curricular Contexts for Infusing the Teaching of Thinking**

It is important that teachers be given opportunities to locate contexts in what they teach to infuse the specific thinking skills and processes that are the focus of a module. Generally, such contexts can be located by asking where it is appropriate to exercise the thinking skill or engage in the thinking process being taught. For example, in history important decisions of historical figures can provide a context for teaching thoughtful decision-making and for gaining an understanding of the decision-making of the figure being studies (e.g. Truman's decision to drop the atomic bomb on Hiroshima).

Didactic and/or generative approaches can be used in this part of the workshop also. A trainer can simply list a variety of contexts that have already been located by others and provide the general principles that these illustrate, asking participants to apply these in their own teaching. For example, a trainer might suggest that finding major historical decisions or key decisions of major characters in stories or novels are good contexts for decision making lessons, and then ask participants to find such contexts in their own teaching. On the other hand, a trainer may simply ask participants themselves to locate such contexts in their own textbooks and curriculum guides, and then try to develop some general principles about types of contexts based on these examples. In either case the trainer should put all of the contexts suggested by the participants together into a "menu" which is distributed to the whole group. Master menu blanks for a number of thinking skills and processes are included in this chapter.
INFUSION integrates direct instruction in specific thinking skills into content area lessons. Lessons improve student thinking and enhance content learning.
INTRODUCTION TO CONTENT AND PROCESS

Teacher's comments to introduce the content objectives.
The lesson introduction should activate students' prior knowledge of the content and establish its relevance and importance.

Teacher's comments to introduce the thinking process and its significance.
The lesson introduction should activate students' prior experience with the thinking skill/process, preview the thinking skill/process, and demonstrate the value and usefulness of doing it skillfully. It serves as an anticipatory set for the thinking and should confirm the benefits of its skillful use.

THINKING CRITICALLY

Active thinking involving verbal prompts and graphic maps.
The main activity of the lesson interweaves the explicit thinking skill/process with the content. This is what makes the content lesson an infused lesson.
Teachers guide students through the thinking activity by using questions in the language of the thinking skill/process and graphic organizers.

THINKING ABOUT THINKING

Distancing activities that help students think about the thinking process.
Students are asked direct questions about their thinking that prompts them to reflect about what kind of thinking they did, how they did it, and how effective it was.

APPLYING THINKING

Transfer activities that involve student-prompted use of the skill in other examples.
There are two broad categories of transfer activities: near or far activities that immediately follow the substance of the lesson and reinforcement later in the school year, reducing the prompting of the thinking process.

Immediate transfer

Near transfer:
Application of the process within the same class session or soon afterward to content similar to that of the initial infusion lesson. Decrease teacher prompting of the thinking.

Far transfer:
Application of the process within the same class session or soon afterward to content different from that of the initial lesson. Decrease teacher prompting of the thinking.

Reinforcement later
Application of the process later in the school year to content different from that of the infusion lesson. Decrease teacher prompting of the thinking.
TEACHING TO INTERNALIZE A THINKING SKILL

TEACHING THE SKILL
Students are prompted to engage in a thinking task with full teacher scaffolding:
1. Organized questioning to guide student thinking
2. Metacognition prompted by questioning
3. Guided application to new examples

PRACTICING THE SKILL
Students are prompted to engage in a thinking task with limited teacher scaffolding:
1. Simple questioning
2. General metacognitive guidance
3. Transfer prompted only if students do not suggest additional examples as appropriate for the skill

USING THE THINKING SKILL INDEPENDENTLY
Students engage autonomously in a thinking task with teacher scaffolding eliminated:
1. Internal student questioning
2. Students recall the process and reflect metacognitively without prompting
3. Students recognize the thinking task as a context for the transfer of previous learning
<table>
<thead>
<tr>
<th>GRADE</th>
<th>SUBJECT</th>
<th>TOPIC</th>
<th>THINKING ISSUES</th>
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## INFUSION LESSON PLAN

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### OBJECTIVES

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### METHODS AND MATERIALS

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### THINKING CRITICALLY

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<th>COMPARING AND CONTRASTING</th>
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<td>1. Similarities?</td>
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<td>2. Differences?</td>
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<td>3. Significance?</td>
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<td>4. Patterns?</td>
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<td>5. Conclusion/Interpretation</td>
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### LESSON

#### INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS

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<td>1. Importance of the thinking</td>
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<td>2. How do you do the thinking</td>
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<td>3. Importance of the content</td>
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#### THINKING CRITICALLY

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<th>SKILLFUL DECISION MAKING</th>
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<td>1. Why necessary?</td>
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<td>2. Options?</td>
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<td>3. Consequences?</td>
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<td>4. Importance?</td>
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<td>5. Choice?</td>
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## Infusion Lesson Plan Organizer

**Title:**

**Subject:**

**Grade:**

### Objectives

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<th>Content</th>
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### Methods and Materials

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### Lesson

**Introduction to Content and Thinking Skill/Process**

**Introduction**

1. Importance of the thinking
2. How do you do the thinking
3. Importance of the content

**Thinking Critically**

**Skillful Causal Explanation**

1. Possible Causes?
2. Possible Evidence?
3. Real Evidence?
4. Likely Cause?
# Infusion Lesson Plan

## Title:

## Subject:

## Grade:

### Objectives

<table>
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<th>CONTENT</th>
<th>Thinking Skill/Process</th>
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### Methods and Materials

### Lesson

**Introduction to Content and Thinking Skill/Process**

1. Importance of the thinking
2. How do you do the thinking
3. Importance of the content

**Thinking Critically**

1. Possible Effect?
2. Possible Evidence?
3. Real Evidence?
4. Likely Effect?

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# INFUSION LESSON PLAN

## CONTENT

### OBJECTIVES

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## METHODS AND MATERIALS

## LESSON

### INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS

**INTRODUCTION**

| 1. Importance of the thinking |
| 2. How do you do the thinking |
| 3. Importance of the content |

### THINKING CRITICALLY

**DETERMINING THE RELIABILITY OF SOURCES**

| 1. Second/third hand? |
| 2. Expertise? |
| 3. Vested interest? |
| 4. Reputability? |
| 5. Corroborate? |
## INFUSION LESSON PLAN

### THINKING ABOUT THINKING

<table>
<thead>
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<tbody>
<tr>
<td>1. Kind of thinking?</td>
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<td>2. How did you do it?</td>
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<td>3. Is it effective?</td>
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### APPLYING THINKING

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<td>1. Immediate transfer</td>
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<td>2. Reinforcement Later</td>
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### EXTENSION ACTIVITY (optional)

### ASSESSING STUDENT THINKING
CHAPTER 5

COACHING TEACHERS ON DESIGNING AND TEACHING INFUSION LESSONS

The Goal of Coaching in Infusion Projects

The component of infusion training that involves the most individualized work is coaching. Coaching means different things to different people, however. In infusion projects a coach facilitates the teacher's own decision making about the lesson by providing feedback and information relevant to how to achieve the lesson objectives. The goal of infusion coaching, therefore, is the production of high quality infusion lessons based on well-informed choices about their design by those who teach them.

Coaching is always lesson specific. Typically, a coach initially meets with a teacher to discuss a lesson that the teacher is planning to teach. This can occur individually, or in small groups. It can also be a prelude to the coach observing the lesson in the classroom, and/or debriefing with the teacher after the lesson has been taught. It can also occur after a lesson has been taught. One-to-one discussion, however, is essential to accomplish the goals of coaching.

Here is a summary of the three typical contexts in which coaching takes place.
- The coach and teacher meet together to discuss a lesson that has been designed prior to its being taught.
- The coach meets with the teacher to discuss a lesson in a pre-instructional conference, the coach observes the lesson being taught, and the two have a post instructional debriefing after the lesson.
- The coach and teacher meet together after the lesson has been taught to discuss the lesson.

The first of these, of course, may be in preparation for the lesson being taught at some later time. It usually takes no more than half an hour. The coach is usually not present for the lesson. The second is, of course, more complex. The pre conference usually takes no more than half an hour, the instruction usually a full class-period, and the post conference again about half an hour. The third involves discussion of a lesson that the coach has not observed after it has been taught.

Coaching Techniques

The initial meeting with the teacher who has designed an infusion lesson is one in which the coach should interview the teacher about how the lesson is structured. It is appropriate for the coach to make suggestions about the lesson, but these should be presented as options that the teacher has the choice to accept or reject. The coach helps the teacher clarify his or her own ideas about how the lesson will be conducted, and provides ideas that may help the teacher achieve his or her own goals.

When the coaching is a pre-instructional conference, the coach also asks what concerns the teacher has about how the lesson will be carried out in the classroom, and offers to watch for these and report back after the lesson is taught. For example, the teacher may be concerned about wait time. How much time is she allowing for students to think about a question and try to respond to it? She may wonder. Is she giving any signs of impatience, she may also wonder.
The coach typically offers to report on his or her perceptions so that the teacher can concentrate on what she is doing during that period.

Coaching teachers about infusion lessons has general features that any good peer coaching should incorporate. For example, it should be non-judgmental and should help the teacher clarify what he or she will do in the lesson. The coaching also has features that are special to infusion coaching. For example, in coaching teachers on their infusion lessons, it is important to ask specific questions about the structure of the lesson. The "Observation/Coaching Guide for Infusion Lessons" is an organizer for a coach to use to help focus on the important ingredients in infusion lessons. There is also a sample list of questions that a coach can use to guide this questioning. In effect, the coach should ask the teacher questions about the following in the initial discussion of the lesson:

- The grade level and subject area of the lesson.
- The content objectives of the lesson.
- The thinking skill objectives of the lesson.
- How the thinking skill and its importance will be introduced to the students.
- How the content emphasis will be introduced to the students.
- Which specific strategies will be used in the introduction to make the thinking strategy that is being taught explicit.
- How the lesson will engage the students in the active use of this thinking strategy in connection with the content being taught.
- What kind of graphic organizer(s), if any, will be used in the lesson and how it (they) will be used.
- What other ways the thinking strategy will be kept explicit as the students go through the thinking activity.
- What strategies will be used in the lesson to prompt the students to reflect on their thinking.

- How the teacher intends to reinforce the thinking skill through transfer activities.

The coach should take notes on the coaching guide as this discussion occurs. If the coach is going to observe the teacher and the teacher indicates specific details that he or she wants the coach to look for, the coach can note these on the guide also. Then, when the coach observes the lesson, the coach may also wish to take notes on the coaching guide as the lesson progresses. If, during the pre-instructional discussion, the coach thinks of strategies that might be helpful, the coach can ask if using these strategies might help achieve the goals of the lesson. If the teacher says she will try out these ideas but would like the coach to observe to see how the students respond, the coach can make note of that also.

If the coach is not going to observe the lesson after the conference with the teacher, the coach may want to ask the teacher to take notes on the lesson after it has been taught. They can decide what the teacher might record in these notes. They then might discuss how the lesson went sometime later. If it is possible for the teacher to be video-taped, that could substitute for a direct observation of the lesson.

During the after-lesson debriefing the coach should report on what he or she observed, speaking specifically to the points of concern raised by the teacher in the pre-instructional conference. If, for example, the teacher was concerned about how long the thinking activity was going to take — she said she was trying to keep it to 15 minutes — the coach can time it and report back. If it was 20 minutes, they might discuss what might be done to keep it to 15 minutes next time. The coach should suggest options, guiding the teacher to think them through and choose what she thinks is best.

The coach can give his or her observation guide to the teacher with the records of
the observation after the debriefing.

**Structures in A School to Support Coaching**

Obviously, coaching requires release time from ordinary teaching responsibilities for both the coach and the teacher coached, as well as for any observers of the process. This can be handled on an *ad hoc* basis for specific coaching episodes. However, if coaching is going to occur with any regularity, a system and structure is required.

The coaching we have been describing is best conducted as peer coaching in specific schools during school hours. There are two basic structures that a school may set up to support this kind of coaching. One involves using already existing non-instructional time, the other involves providing a standard block of time for coaching and relying on the use of substitutes to cover instruction.

On the first model, planning time and early release days, for example, can be designated for coaching on infusion lessons. If this model is used, coaching will usually be in the form of discussions about lessons being designed. It is rare that the complexities of pre-instructional conferences and classroom observation can be accommodated within the time provided for planning and/or early-release days.

Establishing a peer coaching system that provides regular coaching during the school day can take two basic forms. The first involves releasing a coach for a block of time (usually a half or whole day) by providing a substitute for the coach, and then providing another substitute who can follow the coach from teacher to teacher and take over the classes of the teachers being coached as they meet with the coach. This can work using either the conference-only model, or including classroom observations and debriefing in the coaching.

The second way this peer coaching system has been set up is a variation on the first in which other teachers observe the coaching and the lessons, and join in to provide feedback during the post-lesson debriefing. This, of course, requires more release time and the use of substitutes.

These can be mixed and matched. A school may want to support larger coaching sessions of the second sort a few time during the school year, while maintaining an ongoing coaching peer system on a more regular basis.

**Coaching Tips**

Coaches have offered numerous tips as they go through the process. Here are some that may be helpful to you as you begin your coaching:

- The role of the coach is to ask non-judgmental, open-ended questions which focus on the infusion components as the teacher is guided through metacognitive reflection about the lesson.
- Encourage the teacher to tell her main concerns in order to be helpful.
- Analyze and identify the components of the infusion lesson. Confirm that the steps in the process and components of the lesson are clearly and fully developed in the lesson. Have a clear idea yourself about the steps of the thinking process.
- Be sensitive to different teaching styles.
- Guide teachers to look at various strategies.
- Point out the strengths of the lesson and offer suggestions on weak areas.
- Recognize that there is more than one right way to do the lesson.
- Encourage the teacher to critique the lesson.
- Keep body language and non-verbal cues of the observer neutral.
- Listen and observe carefully and record your reactions.
- Ask more questions; fewer statements.
• Confirm that the dual objectives (the content and the thinking process) are well developed.
• Restate the teacher’s concerns.
• Ask open-ended questions to encourage teachers to reflect on decisions and discover subtleties for themselves.
• Keep evaluation out of coaching.
• Correlate coaching teachers for reflection to coaching students for reflection.
• Affirm that the goal of coaching is to help the person offer the best teaching.
### WHY COACH?

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<thead>
<tr>
<th>TRAINING STEPS</th>
<th>SKILLS ACQUISITION</th>
<th>KNOWLEDGE/ MASTERY</th>
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<td>PERIODIC REVIEW</td>
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Questions for Coaches to Raise about the Design of Infused Lessons

What kind of thinking does the lesson seek to improve, and what improvements are sought?

How is the lesson design geared to students' active involvement in the kind of thinking the lesson is designed to improve?

How do the instructional strategies make explicit what students can do to improve their thinking?

To what degree are students prompted to think about their thinking in this lesson? How is that accomplished?

What varied opportunities are provided in this lesson for students to practice the kind of thinking taught?

What methods are used in the lesson to enhance student thinking?

How is the lesson designed so that instruction in the thinking process improves students' understanding of the content?
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<td>3. Think About Thinking</td>
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<td>4. Apply Your Thinking</td>
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<td>5. Other Notes</td>
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APPENDIX
ABRAHAM LINCOLN AND FREDERICK DOUGLASS

American History

Grades 5–12

OBJECTIVES

CONTENT
Students will learn about the roles of Abraham Lincoln and Frederick Douglass in ending slavery in this country and will clarify the difference between being opposed to slavery and being an abolitionist.

THINKING SKILL/PROCESS
Students will compare and contrast effectively by determining similarities and differences between two leaders, by detecting patterns in the significant similarities and differences, and by developing an interpretation or conclusion based on the similarities and differences.

METHODS AND MATERIALS

CONTENT
This lesson features passages about Lincoln and Douglass used in conjunction with background knowledge about them. Guided reading, random calling, higher order questioning, and directed essay writing are employed in this lesson.

THINKING SKILL/PROCESS
Compare and contrast is guided by structured questioning and the use of a graphic organizer. (See pp. 102–107 for reproducible diagrams.) A think/pair/share activity is used to encourage the clear expression of students’ conclusions about the two men.

LESSON

INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS

• Think about a time that you understood something better, or learned to do something more easily, by relating it to what you already knew. For example, when people move from one place to another, they usually note similarities and differences between their new location and their former home. Perhaps the school bus stop is within walking distance in both places but is farther away in the new location than it was where they used to live. Recognizing the difference in distance will help in planning when to leave for the bus. It should probably be earlier than in the previous location.

• When you notice similarities and differences and use that information to make a decision or judgment, you are “comparing and contrasting.” Describe to your partner an example in which you learned something important by comparing and contrasting. Explain how comparing and contrasting the new thing with something you already knew helped you to understand or do things better. After peer discussion, briefly discuss three or four examples.

• In this lesson we are going to learn about the lives of two leaders—Abraham Lincoln and Frederick Douglass. Which do we know better? Abraham Lincoln.

• What do we know about Abraham Lincoln and the time in which he lived that might help us understand the experiences of Frederick Douglass, who lived at the same time? Students may discuss conditions in the United States prior to the Civil War, including their understanding of slavery and the legal debate surrounding it, as well as the fact that Lincoln was president during the Civil War.
Sample Student Responses • Mufaro’s Beautiful Daughters

OPEN COMPARE AND CONTRAST

MUFARO’S BEAUTIFUL DAUGHTERS

CINDERELLA

HOW ALIKE?

Both describe rivalry between daughters in a family.

Both result in a royal marriage for the girl selected.

In both stories, magic allows animals to change form.

In both stories, kindness wins out over selfishness.

Both stories occur at a time when kings and queens were rulers.

In both stories, the girl selected to be queen comes from the common people.

Both stories have a happy ending.

HOW DIFFERENT?

WITH REGARD TO

LOCATION

PARENTS

RELATIONSHIP

USE OF MAGIC

WHY CHOSEN

The story takes place in Africa.

The father is the only parent in the story.

The sisters were natural sisters.

Magic is used to test the girls who would be queen.

The king picks his bride for her worthiness and beauty.

The story takes place in Europe.

There is a father and a stepmother, but the stepmother makes most of the decisions.

The sisters were stepsisters.

Magic is used to help the girl who is unfairly treated.

The prince picks his bride for her beauty alone.

CONCLUSION OR INTERPRETATION:
Worthiness, as well as beauty, is important in choosing a queen in the African folktale, but beauty alone is important in the European tale.
THINKING ACTIVELY

- First read the passage about Abraham Lincoln. As you read the information about Frederick Douglass, be alert to ways that he and Lincoln are alike. Each time you find a similarity, write it on a line in the box of the diagram under “How Alike.” Also, look for ways that Lincoln and Douglass are different. Write the differences on the lines under “How Different.” Think about what that difference means and write it over the arrow. For example, Abraham Lincoln was Caucasian and Frederick Douglass was Black. What term describes that difference? Race. Write “race” over the arrow. Give the students enough time to list at least three similarities and three differences on the diagram. After they have finished reading the passages, call on students randomly to report similarities and differences that they have found. Ask for only one similarity or difference from each student. Record their responses on a transparency, on an overhead projector, or on a large diagram on the chalkboard. Encourage students to add any similarities or differences that they find interesting, suggested by other class members, to their individual diagrams.

- How are Abraham Lincoln and Frederick Douglass alike? After they have finished reading the passages, randomly call on four or five students to report one similarity that they have found. Record their responses on an overhead transparency or on a large diagram on the chalkboard. Draw out the student’s thoughts by asking for clarification or extension of the responses—the cause, effect, significance, implications, etc. POSSIBLE ANSWERS: Both men lived in the same period, were born into very poor families, were self-educated, were intelligent, lost their mothers at an early age, spent their young adulthood on farms, and moved from border slave states to free states. Both men used language to persuade others and contributed to ending slavery in America.

- How are Abraham Lincoln and Frederick Douglass different? Record differences, asking what each difference describes and writing it over the arrow. Continue to ask extending questions about the cause, effect, significance or implications of each difference between the two men. After the class diagram is completed, encourage students to add any similarities and differences they wish to their own diagrams. POSSIBLE ANSWERS: Lincoln was Caucasian; Douglass was of African descent. Lincoln was born free with all the civil rights guaranteed to Americans; Douglass was born a slave with no civil rights, even the right to life. Lincoln was born free; Douglass purchased his freedom. Lincoln was a lawyer and a politician; Douglass was a writer and newspaper publisher. Lincoln used the war powers of the presidency to free slaves in the confederate states; Douglass used his newspaper to influence public opinion regarding rights and opportunities for blacks. Lincoln was assassinated at age 56; Douglass died of natural causes at age 77. Lincoln was primarily an orator; Douglass was both an orator and writer. Students also include among the differences that while both men opposed slavery, Douglass was an abolitionist and Lincoln was not. To clarify the distinction between being an abolitionist and just opposing slavery, students’ comments or teacher explanations may include the following:

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factors: Abolitionists believed that the assumption that one person could own another was wrong and that slavery should be abolished by whatever means necessary. Lincoln, on the other hand, believed that while slavery was undesirable, should not be extended to new territories, and should be abandoned if legal means could be found to do so, it was nevertheless sanctioned by the right to property in the Constitution. The war powers of the president, invoked by Lincoln during the Civil War to issue the Emancipation Proclamation, allowed Lincoln to confiscate the property of slaveholders and free the slaves by legal means.

- Now let’s think about the similarities and differences on your diagram. There are many true things that we could say about the two men that may not be very important. For example, both men wore trousers. This, however, does not add to our understanding of these two men. We want to base our understanding of them on factors that are important. Draw a line through any similarities and differences that are not important. Student responses will vary. Students may predictably ask what is meant by “important.” Any information, the omission of which would limit our understanding of the two men, their characters and interests, and/or their impact on others would be considered important.

- Are there any common ideas that you find in the important similarities and differences? For example, many of the similarities and differences mentioned describe the backgrounds of the two men. What other patterns of similarities and differences do you find? Write these in the “patterns” box. After students have an opportunity to reflect and write, ask for three or four responses. POSSIBLE ANSWERS: Their backgrounds, the value they placed on education, their impact on slavery, their rise from poverty to become self-supporting in distinguished professions.

- Now think about something interesting that you have learned about the two men based on your comparing and contrasting. What do the similarities and differences you have noted tell you about Abraham Lincoln and Frederick Douglass? In the bottom box, write one sentence that expresses a conclusion or interpretation that is suggested by important similarities and differences in the lives of the two men. Ask students to write their conclusions.

- We’re going to do an activity called “Think-Pair-Share.” Each of you should pair up with a partner. One student in the pair should then read his or her statement. The partner serves as a listener to assist the speaker in expressing the conclusion clearly. The listener may only ask questions:

  Questions of clarification: If you don’t understand what a word means or the meaning of the statement, you may ask questions which help you understand what is being said. For example, you may ask, “What do you mean when you say ——?”

  Questions which extend the idea: If you think your partner is saying something interesting, but it is too brief, you can ask for more details about your partner’s idea. You might say something like “What more can you tell me about ——?”

  Questions to challenge what is said: If you think the speaker is misled or confused, you may ask questions that you think may prompt your partner to rethink or restate some part of his or her statement like “Why do you think ——?” Maybe the speaker will explain why and you won’t think the statement is confused anymore, or maybe the speaker will reconsider aspects of the statement.

After two minutes of reflection, signal students to change roles. After both partners have served as speaker and listener, allow students an opportunity to rewrite their statement in any way they see fit. Ask for volunteers to read their statements to the whole class. Ask them to repeat their statements so that other students can listen to each statement twice, once for content and once
to identify the kind of statement the student is reading (comparison, contrast, both comparison and contrast, cause/effect, generalization, etc.). Ask the class which details from the diagram could be used to support the conclusion if the statement was the main idea for an essay assignment. Create a composite bulletin board of students’ conclusions about the two stories. POSSIBLE ANSWERS: Although Lincoln and Douglass experienced hardship and limitations as young men, they were able to rise to positions of influence and power. Abraham Lincoln and Frederick Douglass were of different races but worked for the same purpose. While Lincoln and Douglass opposed slavery for different reasons, they both contributed significantly to ending it in this country. Both men showed determination in bettering themselves and, through this achievement, bettered the lives of countless others in this country. Frederick Douglass, in contrast to Abraham Lincoln, had to win his freedom and then used its advantages to work for the freedom of Blacks and for women’s suffrage.

**THINKING ABOUT THINKING**

- Let’s stop thinking about Lincoln and Douglass and focus our attention on what we did to think about these two men in order to learn something important about them. The kind of thinking we did was called “comparing and contrasting.” What did we do to compare and contrast Lincoln and Douglass? What, for example, did you think about first? Next? Prompt students to recall the steps in the process. Record their strategy on the board or use a transparency of the thinking map, uncovering each step as students identify it. Review the discussion for each step of the thinking map of open compare and contrast.

- How was the compare-and-contrast process different from just identifying similarities and differences? Student answers should focus on thinking about the differences by asking what kind of differences they are, by looking for patterns in the similarities and differences, and by drawing conclusions from the similarities and differences noted.

- Is comparing and contrasting in this way helpful in thinking about things? How? Students comment that it allows them to think about what the similarities and differences mean.

- How did the way that you compared and contrasted the two men differ from the way you usually study historical characters? Students say that comparing and contrasting helps them look for important information as they read about these people, in contrast to just attending to their names and when they lived. Students often comment that this process “personalizes” these leaders in the sense that they seem like real people.

- Was using the graphic organizer helpful to you? How? Students comment that using the diagram assists them in recording details that they notice and might otherwise forget. They also say that the graphic organizer helps them draw a conclusion from the similarities and differences they have listed.

- In the Think-Pair-Share activity, was writing out your statement beforehand important? Students recognize that, for clarity and ownership, having their thoughts written down before discussion frees them to examine the meaning and implications of their conclusions.
APPLYING THINKING

Immediate Transfer

- Compare and contrast the experiences of Frederick Douglass and Josiah Henson, the escaped slave whose life is depicted as "Uncle Tom" in Harriet Beecher Stowe's Uncle Tom's Cabin, to illustrate life under slavery, escape, and assistance to other slaves.

- We are studying Sojourner Truth and Harriet Beecher Stowe. Compare and contrast the two women to examine how they affected public opinion about slavery.

- We have been studying conditions in the North and the South at the start of the Civil War. Compare and contrast the population, industry, food production, coashline, and railroads in the North and the South to determine their relative ability to sustain a lengthy war.

- Compare and contrast literary works about Lincoln and Douglass. What do these works tell us about the writers' views of these two men? Lincoln poems include "When Lilacs Last on the Dooryard Bloomed" and "Oh Captain, My Captain" by Walt Whitman; "What Is God's Will" and "Abraham Lincoln" by Stephen Vincent Benet; and "Lincoln" by John Gould Fletcher. Douglass Poems include "I Was Frederick Douglass" by Hildegard Smith and "Frederick Douglass" by Paul Laurence Dunbar.

- Compare and contrast two characters from stories you have read recently to understand how the two characters responded differently to conditions in the stories.

- Compare and contrast two breakfast cereals in order to decide which is a better buy and which is more nutritious.

Reinforcement Later

- Compare and contrast two different pieces of music or stories.

- Compare and contrast the civil rights of blacks and whites during Reconstruction.

FOCUSED COMPARE AND CONTRAST OPTION

This lesson can be taught as a focused compare and contrast lesson. If you take this option, use the focused compare and contrast graphic organizer, and guide students to compare and contrast Lincoln and Douglass. They should define the purpose of the comparison and contrast, list the factors to consider in order to achieve this purpose, and then search in the passages for information about Lincoln and Douglass that falls into the categories they have specified. As they find information, it should be recorded under "How Alike" or "How Different," as appropriate. Sample student responses using a focused compare and contrast graphic organizer are included on page 128.

RESEARCH EXTENSION

Corroborate details in the passages about Lincoln and Douglass by consulting other works in the school library. Make sure your sources are reliable. Modify your comparison and contrast diagram, if necessary, to reflect what you find. Students may obtain more information from biographies of Lincoln and Douglass. Two Roads to Greatness (Macmillan Company, New York, 1967) provides biographical and literary works about the two leaders.
WRITING EXTENSION

Use your concluding statement as the main idea or conclusion for a short essay about Lincoln and Douglass. Use what you have written in the graphic organizer for your supporting details. You may include additional information about the two leaders from resources you find in the school library.

ASSESSING STUDENTS' THINKING ABOUT COMPARING AND CONTRASTING

To assess this skill, ask students to write an essay on any of the application questions or others which you select, using a graphic organizer to assist themselves. Ask students to describe how they compared and contrasted the two subjects. Determine whether they are attending to each of the steps in the thinking map for comparing and contrasting.
ABRAHAM LINCOLN AND FREDERICK DOUGLASS

Abraham Lincoln

Abraham Lincoln was born in Hardin County, Kentucky in 1809. When he was eight, the family moved to Spencer County, Indiana, where he grew up. His mother died when he was ten years old. Since his family was very poor, Lincoln began working at an early age. Although there were some schools in the Indiana territory, he had little formal schooling and was largely self-taught. He worked on a farm until he was twenty-two years old, and then in 1831 moved to Menard County, Illinois, where he worked as a clerk in a store. From 1834 to 1840, Lincoln served in the Illinois legislature, studied to become a lawyer, and moved to Springfield, Illinois, to practice law. He served one term in the U. S. House of Representatives from 1847 to 1849 then returned to his law practice.

In 1860, Abraham Lincoln was elected president of the United States. He immediately faced with the secession of southern states from the Union and the beginning of the Civil War. Although he disapproved of slavery, Lincoln was not an abolitionist (one who believed that slavery should be done away with). He recognized that slave owners had paid for their slaves. Since slaves were considered to be property, it was believed to be unlawful to take someone's property away. Once the southern states had become enemies of the Union, President Lincoln used his war powers as Commander-in-Chief of the Army to abolish slavery in the southern states. In September 1862, Lincoln proclaimed that unless the southern states rejoined the Union by January 1, 1863, their slave property would be considered legally confiscated. Thus, Lincoln acquired the legal right to free the slaves.

Abraham Lincoln was re-elected President in 1864 but was assassinated in 1865.

Frederick Douglass

Frederick Douglass was born a slave in Tuckahoe, Maryland. Since slaves were seldom told their ages, Douglass estimated that he was born about 1818. His mother, Harriet Bailey, was hired out to a distant farmer shortly after his birth and died when Douglass was about eight years old. Like many slaves, Douglass never knew who his father was.

Frederick Douglass was taught the alphabet by Mrs. Thomas Auld until his master, Mr. Auld, discovered that she was teaching Frederick to read. It was unlawful to teach a slave to read. Frederick realized that reading was an important distinction between slaves and free men. Frederick taught himself to write by copying words in the spaces of his young master's writing book.

In 1838, Douglass bluffed his way onto a train to Delaware, a slave state, then went by boat to Philadelphia and freedom. He moved to Massachusetts and selected the name Douglass to replace his slave name.

Douglass bought his freedom from his old master. In 1847, he started a newspaper in Rochester, New York, advocating the abolition of slavery and supporting women's voting rights.

Douglass encouraged Lincoln to include black troops in the Union Army and used the power of his newspaper to encourage blacks to enlist. The first black regiment was formed in 1863, with Douglass' own sons among the first to enlist. In 1864, Douglass met with Lincoln to secure the same wages, protection, and awards for black soldiers as for white soldiers.

In 1866, Douglass was the only black delegate elected to attend the post-war convention on reconstruction. In 1877, President Hayes appointed Douglass marshal of the District of Columbia. He later served as the U. S. representative to Haiti.

Frederick Douglass died in 1895 of a heart attack.
Sample Student Responses • Lincoln and Douglass

**OPEN COMPARE AND CONTRAST**

<table>
<thead>
<tr>
<th>ABRAHAM LINCOLN</th>
<th>FREDERICK DOUGLASS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HOW ALIKE?</strong></td>
<td></td>
</tr>
<tr>
<td>Both were born into very poor families.</td>
<td></td>
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<tr>
<td>Both were self-educated.</td>
<td></td>
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<tr>
<td>Both used language to persuade others.</td>
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<tr>
<td>Both contributed to ending slavery in the United States.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>HOW DIFFERENT?</strong></th>
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<tbody>
<tr>
<td><strong>WITH REGARD TO</strong></td>
</tr>
<tr>
<td>CIVIL RIGHTS</td>
</tr>
<tr>
<td>EFFECTS OF RACE</td>
</tr>
<tr>
<td>ABOLITION</td>
</tr>
<tr>
<td>INFLUENCE</td>
</tr>
<tr>
<td>He was born a free citizen with all the rights guaranteed to Americans.</td>
</tr>
<tr>
<td>His opportunities were not limited by his race.</td>
</tr>
<tr>
<td>He was opposed to slavery but was not an abolitionist.</td>
</tr>
<tr>
<td>He used the War Powers Act to free slaves and establish military service for blacks.</td>
</tr>
<tr>
<td>He was born a slave with none of the rights guaranteed to Americans.</td>
</tr>
<tr>
<td>Even as a free black man, his opportunities were limited.</td>
</tr>
<tr>
<td>He was an abolitionist who believed that one person could not own another.</td>
</tr>
<tr>
<td>He used his newspaper to inspire both blacks and whites to respect the rights of blacks.</td>
</tr>
</tbody>
</table>

**PATTERNS OF SIGNIFICANT SIMILARITIES AND DIFFERENCES:**
Family background, leadership, effect on ending slavery.

**CONCLUSION OR INTERPRETATION:**
Both men showed determination to better themselves and, through this achievement, used its advantages to better the lives of countless others in this country.
Sample Student Responses • Lincoln and Douglass • Focused Compare and Contrast

FOCUSED COMPARE AND CONTRAST

LINCOLN

GOALS: To clarify how Lincoln and Douglass contributed to ending slavery in the United States

FACTORs TO CONSIDER: Goals, priorities, attitudes towards slavery, methods, accomplishments, effectiveness

FACTORS CONSIDERED IN THIS ACTIVITY:

- Goals
- Methods
- Effectiveness
- Priorities
- Attitudes towards slavery
- Methods
- Accomplishments
- Effectiveness

HOW ALIKE?

- They opposed slavery.
- They both used language persuasively.
- Both influenced a great many people to oppose slavery.

HOW DIFFERENT?

- To save the Union and uphold the Constitution while opposing slavery
- Believed slavery was unacceptable, (though it was legal)
- Legal means; the power of the presidency
- The Emancipation Proclamation
- Legally freed slaves in southern states.
- Abolition of slavery
- Believed that no person could own another
- Oratory and writings; anything means acceptable
- Newspaper and his own writings
- Increased public awareness of the plight of slaves

CONCLUSION OR INTERPRETATION:

While both Lincoln and Douglass worked towards the goal of ending slavery, Lincoln was constrained by legal considerations, regarding slaves as property, that Douglass did not accept, but ultimately Lincoln used the power of the presidency to work within the law to free slaves.
I'm going to tell you about a time when I had to make a decision. I wanted to take a vacation away from home, and I had to choose between going skiing where it was cold or going to the beach where it was hot. I couldn't go to both places, so I finally chose to go to the beach.

Now, this is about a time when you had to decide about something and weren't sure what was best. Take turns and tell your partner what you were thinking about doing. Give students enough time for both students in each pair to relate their decisions. If necessary, prompt the class to switch roles in order to give each partner a chance to relate his or her decision.

• Let's hear some of the examples you just discussed. Ask for three or four examples from the class.

• What kind of thinking helped you figure out what to do? POSSIBLE ANSWERS: Picking, choosing, deciding. Write these words on the top of the board as a main heading.

• The different things you were thinking about doing are called "choices" or "options." Write these words on the board under the main heading. Let's hear one of the choices or options you were thinking about when you were trying to decide. ANSWERS VARY.

• In order to pick the best thing to do, we usually think about what will happen if we do it. We do this to figure out the good and bad things that might happen. These are usually called "Results" or "Consequences" of our options. Write these words on the board under options, and write "Pro" and "Con" after them. Explain that we use "pro" for things that are good, things we want to happen, and "con" for things that are bad, things we don't want to happen.

• Pick one of your options and discuss with your partner what might happen if you chose it. Which of these consequences would you want to happen and which would you not want to happen?
WRITING A STORY

TO BE USED TOGETHER WITH A COMPLETED DECISION MAKING GRAPHIC ORGANIZER

Paragraph I:
Tell about the situation in which a character finds himself or herself that makes a decision necessary.

Paragraph II:
Choose an option from the graphic organizer and write about the character choosing that option. Explain why the character chose this option.

Paragraph III:
Write about how one of the important positive (or negative) consequences of the option described in the graphic organizer occurred and how it affected the character.

Paragraph IV:
Write about how one of the important negative (or positive) consequences of the option described in the graphic organizer occurred and how it affected the character.

Paragraph V:
Finish the story with one of the following:
• a happy ending by describing the best consequence,
• an unhappy ending by describing the worst result
• leave the character with another decision to be made because, while some of the consequences are positive, some are also negative, and the character must choose something else that is better.
After we've thought about the consequences of our options, we can pick the best thing to do. The best thing will be the choice that has more pros and fewer cons than any of the other choices. Write "Choose the best thing to do" under "Consequences—pro and con." This thinking map shows what we need to think about when we make a decision. Show a copy of the chart at the right.

Now tell your partner what you decided to do. What did you think about in order to pick the best thing to do?

When we read stories, we hear about many characters who make decisions. It's interesting to think about whether they picked the best thing to do. We're going to read part of a story. As we do, we're going to think about a decision that one of the characters makes and try to figure out the best thing to do.

THINKING ACTIVELY

I'm going to read the first few pages of Horton Hatches the Egg by Dr. Seuss. Listen for the decisions that Horton the elephant makes. Let's try to understand why he makes them. Read the book to the students and, when you get to the refrain, ask them to join in and repeat

"I meant what I said
And I said what I meant...
An elephant's faithful
One hundred per cent!"

Show the pictures as you read. Continue reading up to the part where Horton's friends make fun of him.

What decision did Horton make at the beginning of the story? ANSWER: To take care of the egg for the bird. What does that tell you about Horton? POSSIBLE ANSWERS: He's a nice elephant. He's helpful. He wants to do good. What does Mayzie's decision tell you about the bird? POSSIBLE ANSWERS: Mayzie is lazy, doesn't care about Horton, and tricks people.

Were there any consequences that Horton didn't think about when he decided to take care of the egg? POSSIBLE ANSWERS: He didn't think about how wet he would get when it rained or how cold he would get when winter came. He didn't think about what would happen if the mother bird didn't come back. He didn't think about how uncomfortable sitting on the egg would be. If students have difficulty answering this question, ask them what things happened that Horton didn't expect.

Was it a good decision to take care of the egg? If you had thought about the consequences before agreeing, would you have decided to stay with the egg? POSSIBLE ANSWERS: I would have stayed because keeping the egg warm is important even if I get wet. I would have brought my raincoat and winter jacket, but would still have stayed on the egg so that it wouldn't die.

Now let's read a little farther in the story. Continue up to the part where the hunters approach the scene. Stop reading with the following:

"He heard the men's footsteps! He turned with a start!"

Let's think about the problem Horton now has. Getting wet and cold made Horton feel uncomfortable. Now what does Horton find? Some hunters with guns. What could be the

CHOOSING

1. What are some things I can do?
2. What will happen if I do these things?
3. Which are good things to do?
consequence? They could shoot Horton. Would that be a good thing? No, because Horton could die and then the egg would also die. Is that more serious than just getting wet and cold? Yes. Being alive is more important than being comfortable.

- Suppose that you were Horton. Let's use our plan to decide what Horton should do. Remember what comes first: What are Horton's options? What could Horton do? Talk to your partner and try to come up with three or four options. After a few minutes, ask the students to report. Get as many options as possible, one at a time, from different groups. Write the options on a transparency or drawing of the graphic organizer. POSSIBLE ANSWERS: Fight the hunters, run away without the egg, run away with the egg, stay on the egg, talk to the hunters and tell them what he's doing and ask them to go away, hide, make himself look like a tree, give them something nice in trade for not hurting him.

- Now let's figure out which option is the best thing to do. Let's think about the consequences and list them as pros or cons. Let's try this first with the option "Horton runs away without the egg." What do you think might happen? POSSIBLE ANSWERS: Pros: Horton would escape. The hunters would be unhappy. Horton wouldn't have to be cold again. Cons: Horton would feel guilty because he had broken his promise. Mayzie would be angry when she returned. The egg would die.

- Is it a good option to run away without the egg? Why or why not? POSSIBLE ANSWERS: No, because the egg would die and that's important. Horton would be breaking his promise and, even though he'd escape, he might feel guilty.

- Discuss another option with your partner. Think of some things that might happen if Horton did that. Decide whether these results are pro or con. Assign each group a different option. On a transparency or on the board, write the consequences the students generate.

- Let me summarize the pros and cons of each option. Discuss with your partner what you think the best option is. Ask the students to vote on the best option. Check the one that gets the most votes. Then ask students why they voted for their option.

- Now we are going to read the rest of the story. Let's see what Horton decides to do. Let's think about why he decides what he does. Finish reading the story, and ask students why Horton decides to stay with the egg. Coach them by prompting them to repeat the refrain. Ask them what Horton's decision tells them about him. POSSIBLE ANSWERS: He's brave. He loves the bird in the egg. He cares a lot about the bird in the egg. He keeps his promises no matter what.

- Is Horton's decision better than yours? Why? Ask this question only if what Horton decides is different from what the class decides.
THINKING ABOUT THINKING

- When you were making your decision, you thought about Horton's options when the hunters arrived. Were Horton's options important to think about? Why or why not?

- Was it a good idea to think about the consequences of Horton's options the way we did? Why?

- If Horton had to make another decision, what would you tell him to think about? Draw a picture that can help Horton make better decisions. Accept any diagram that emphasizes options and consequences.

APPLYING THINKING

Immediate Transfer

- Use your plan for decision making to figure out what you can do next weekend.

- In the story of Peter Rabbit, Peter makes lots of decisions. Use your plan for decision making to decide what Peter should do when he gets to Mr. McGregor's garden.

Reinforcement Later

Later on in the school year, introduce this additional transfer activity by saying the following:

- In science we're studying what animals need in order to stay alive. Pick an animal. Use your plan for making decisions to choose something you can do to help one of these animals to live and grow.

ART EXTENSION

After your students have brainstormed options for Horton, ask them to select one option and draw a picture of Horton doing it.

ASSESSING STUDENT THINKING ABOUT DECISIONS

To assess student thinking about decisions, use a decision problem, such as what to do for the weekend or during recess. Ask students to identify each step of decision making as they think about the problem. Prompt students to use the right terms for their thinking. Determine whether they are attending to each of the steps in the thinking map for decision making that you developed. Because students in first and second grade may not write easily, you may conduct this assessment orally, either individually or in small groups.
SAMPLE STUDENT RESPONSES • HORTON AND THE HUNTERS

CHOOSEING

OPTIONS
What can Horton do?

- Run away without the egg.
- Run away with the egg.
- Ignore the hunters.
- Talk to the hunters. Tell them what he's doing and ask them to go away.
- Fight the hunters.
- Give the hunters something nice in exchange for not hurting him.
- Make himself look like a tree.
- Hide from the hunters.

YOUR OPTION
Run away without the egg

RESULTS
What will happen?

PRO

- Horton may escape.
- Horton won't be afraid anymore.
- Horton won't have to get cold anymore sitting on the egg.

CON

- Horton will feel bad because he broke his promise to Mayzie.
- If Horton falls down, the hunters would get him.
- The egg will die.
- Mayzie will get upset when she returns and finds her egg dead.

CHOICE
Is this a good thing to do?

No

Why?

Because it's very important to keep the egg alive and Horton made a promise to Mayzie to take care of the egg.
### CHOOSING

#### OPTIONS

<table>
<thead>
<tr>
<th>What can Horton do?</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Run away without the egg.</td>
<td>Fight the hunters.</td>
</tr>
<tr>
<td>Run away with the egg.</td>
<td>Give the hunters something nice in exchange for not hurting him.</td>
</tr>
<tr>
<td>Stay and faces the hunters.</td>
<td>Make himself look like a tree.</td>
</tr>
<tr>
<td>Talk to the hunters. Tell them what he's doing and ask them to go away.</td>
<td>Hide from the hunters.</td>
</tr>
</tbody>
</table>

#### YOUR OPTION

Stay and face the hunters

#### RESULTS

**PRO**

- The hunters might not shoot because Horton is brave.
- Horton keeps his word to Mayzie.
- The hunters might miss.

**CON**

- The hunters might shoot Horton.
- The hunters might capture Horton and take him away from the egg.
- The hunters might steal the egg and sell it.

#### CHOICE

**Is this a good thing to do?**

Maybe if the hunters are nice and don't hurt Horton.

**Why?**

Because Horton made a promise to Mayzie to take care of the egg and that's important.
## MR. ARABLE AND THE RUNT PIG

### Language Arts

**Grade 3**

<table>
<thead>
<tr>
<th>OBJECTIVES</th>
<th>CONTENT</th>
<th>THINKING SKILL/PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students will learn to think about story characters in terms of their character traits and actions</td>
<td>Students will learn to think about options and the likelihood of the consequences of those options in making decisions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>METHODS AND MATERIALS</th>
<th>CONTENT</th>
<th>THINKING SKILL/PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students read part of a story, use background information, work in collaborative learning groups to share information, and record it in a graphic organizer. The book Charlotte's Web is needed.</td>
<td>An explicit thinking map, a graphic organizer, and structured questioning emphasize options, consequences, and reasons in decision making. (See pp. 39-43 for reproducible diagrams.) Collaborative learning in groups of four enhance the thinking.</td>
</tr>
</tbody>
</table>

### LESSON

**INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS**

- Think about a time when you had to make a decision and you weren't sure what to do. Tell your partner what you were thinking about doing. Give students enough time for both students in each pair to relate their decisions. If necessary, prompt the class to switch roles in order to give each partner a chance to relate his or her decision.

- Let's hear some of the examples you just discussed. Ask for three or four examples from the class. Write each decision at the top of a column under the word "Decisions."

- When thinking about what to do, your thinking is called "decision making." The different choices you were thinking about are called "options." Write "Decision Making" and "Options" on the board. Under the word "options," list the alternatives that students mention.

- Now tell your neighbor what you decided to do and how you figured it out. What did you think about to pick the best thing to do?

- When people are trying to decide what to do, they sometimes think about what will happen as a result of their decision. These results are called the "consequences" of their options. What were some of the consequences you were thinking about? Write the word "consequences" on the board, and list some of the consequences students mention.

- In making decisions, you should have a good reason for expecting particular consequences. Write the word "reason" on the board.

- Tell your neighbor your reasons for thinking that your decision would have the consequences you mentioned. Ask the students to mention some reasons, and list these on the board under "reasons."

- After you think about which of the consequences are important, you are ready to make the
best choice. Here’s a thinking map putting all of these ideas together. It tells us what we should think about when we are trying to make a decision. Show a copy of the thinking map at the right.

- We’ve been thinking about our own decisions. Now, think about decisions that were made by characters in stories you’ve read. Describe some of those decisions. Get three or four examples from the class.

- As we read stories, we can understand the characters better by thinking about why they made their decisions. We’re going to read part of a story. As we do, we’re going to think about a decision that one of the characters is trying to make and what that decision tells us about the kind of person that character is.

**THINKING ACTIVELY**

- I’m going to read the first few pages of the book *Charlotte’s Web* by E. B. White. Listen for the decisions that the characters make in this passage.

  “Where is Papa going with that ax?” said Fern to her mother as they were setting the table for breakfast.

  “Out to the hoghouse,” replied Mrs. Arable. “Some pigs were born last night.”

  “I don’t see why he needs an ax,” continued Fern, who was only eight.

  “Well,” said her mother, “one of the pigs is a runt. It’s very small and weak, and it will never amount to anything. So your father has decided to do away with it.”

  “Do away with it?” shrieked Fern. “You mean kill it? Just because it’s smaller than the others?”

  Mrs. Arable put a pitcher of cream on the table. “Don’t yell, Fern!” she said. “Your father is right. The pig would probably die anyway.”

  Fern pushed a chair out of the way and ran outdoors. The grass was wet and the earth smelled of springtime. Fern’s sneakers were sopping by the time she caught up with her father.

  “Please don’t kill it,” she sobbed. “It’s unfair.”

  Mr. Arable stopped walking.

  “Fern,” he said gently, “you will have to learn to control yourself.”

  “Control myself?” yelled Fern. “This is a matter of life and death, and you talk about controlling myself.” Tears ran down her cheeks and she took hold of the ax and tried to pull it out of her father’s hand.

  “Fern,” said Mr. Arable, “I know more about raising a litter of pigs than you do. A weakling makes trouble. Now run along!”

  “But it’s unfair,” cried Fern. “The pig couldn’t help being born small, could it? If I had been very small at birth, would you have killed me?”

  Mr. Arable smiled. “Certainly not,” he said, looking down at his daughter with love. “But this is different. A little girl is one thing, a runty pig is another.”

  “I see no difference,” replied Fern, still hanging onto the ax. “This is the most terrible case of injustice I have ever heard of.”

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• What decisions do the characters make in this passage? POSSIBLE ANSWERS: Mr. Arable’s decision to kill the runt pig, Fern’s decision to try to get her father to spare the pig, Fern’s decision to grab the ax, Mr. Arable’s decision to reason with Fern, Fern’s decision to try to convince her father, Mrs. Arable’s decision to tell Fern what her father plans.

• Let’s think about Mr. Arable’s decision to kill the runt pig. Suppose you were Mr. Arable and that what Fern says makes you think again about what to do about the runt pig. Let’s look at the decision-making map and ask the first question: What makes a decision necessary? Why do you think Mr. Arable feels he has to make a decision here? POSSIBLE ANSWERS: A litter of pigs was born last night. One of the pigs was a runt. Mr. Arable remembers how much trouble raising a runt pig has caused in the past. It may cost a lot of money to care for the runt pig. Fern has raised questions about whether killing the pig is the best thing to do.

• Now let’s look at the next question: What are Mr. Arable’s options? What else could he do? We will use a special diagram that can help us think more carefully about decision making. It has a box for “Options.” Work together in groups of three or four and try to come up with as many options as you can. Try to think of different kinds of options, including some unusual ones; and write them on the diagram. POSSIBLE ANSWERS: Take care of the pig himself, give the pig away, sell the pig, let Fern take care of the pig, lie to Fern and kill it anyway, do nothing (let the pig fend for itself), advertise for someone who can take care of the pig, make it a pet, kill it anyway, abandon the pig in the woods.

• Tell us one option from your group’s list. As each group of students responds, write these on the board or on a transparency of the diagram under the word “Options.” Then ask for volunteers to add options that haven’t been mentioned. As you list responses, ask for elaboration of some by the students who offer them.

• Let’s follow the decision-making map and think about the consequences of one of the options: giving the pig to Fern to raise. We should think about the consequences of our options so that we can decide which option is best. What might be the consequences of giving the pig to Fern to raise? Write “Give the pig to Fern to raise” under “Option Considered.” Then list consequences that might result if Mr. Arable did that. Make sure you think about consequences for others as well as for Mr. Arable and about both long-term and immediate consequences. Ask the students for suggestions about the consequences, and fill in the graphic organizer as they give them. POSSIBLE ANSWERS. Fern will be relieved. The pig will die anyway. Fern will learn how hard it is to keep an animal alive. Fern will be able to keep the pig alive. Fern will feel that her father values her ideas. Fern will learn farm responsibility. Raising the pig will take Fern away from other chores on the farm, and pig care could become time consuming and expensive for the family. The pig

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may live and grow normally. Fern will learn about death. Fern will understand the wisdom behind her father's decisions. The parents may disagree over the decision. Pig care may come back to the parents. Mr. Arable may feel guilty about giving Fern the responsibility if the pig dies. The pig may breed other small pigs.

- Remember how important it is to make sure that you have reasons for thinking the consequences will really happen. Let's think about the first consequence—that Fern will be relieved. What do we know about Fern from the story that is a reason for thinking she will be relieved if her father gives her the pig to raise? We'll write that in the "Support" column on the diagram. Since we have a reason that supports it, we'll put a check mark next to the consequence. If you can't find a reason or if there is a reason against thinking the consequence will happen, we'll cross out the consequence. Write what the students suggest on the graphic organizer. As you fill in student responses, your organizer should resemble the one at the right.

- Now work in your groups to come up with the consequences for another option. Assign one group to finish discussing this option and complete the diagram. Let each of the other groups pick another option. Write down what you think the consequences might be for your option. Then see if you can find reasons for thinking the consequences will really happen. You can use information from the story or what you know about animals, farms, and people. Cross out any consequences for which you can't find support. After five minutes, ask the groups to report by telling what the option is and whether the reasons show that the consequences are likely.

- In your groups again, think about whether each likely consequence counts in favor of or against the option you have chosen. Put a plus next to the consequence if it counts in favor of the option; use a minus if it counts against the consequence; if the consequence is important, circle it, and explain why it is important in the last column on the diagram.

- Now pick what you think is the best thing for Mr. Arable to do. Explain why. Ask each group to report. After the discussion, ask the class to vote on the best thing to do.

- We've done some decision making by thinking carefully about what Mr. Arable should do. Let's read the rest of this chapter of Charlotte's Web to see what Mr. Arable decides to do. When you find out, think about what Mr. Arable's decision tells us about the kind of person he is. Write down two words or phrases that describe Mr. Arable. Read the rest of the chapter aloud. Ask a number of students to report on their descriptions and why they chose these. POSSIBLE ANSWERS: Fair, thoughtful, listens to Fern, kind, open-minded.
THINKING ABOUT THINKING

- How did you think about what Mr. Arable should do? What did you think about first, second, and so on? POSSIBLE ANSWERS: Options first, then consequences, then evidence about how likely the consequences were, and then what the best thing to do is.

- Look at the thinking map of decision making. Is that a good way to describe how you thought about what Mr. Arable should do? ANSWERS VARY, BUT STUDENTS GENERALLY AGREE THAT IT IS.

- Is this a good way to make a decision when you're not sure what to do? Is it good to do this even when you feel pretty confident about your choice? Is it better than the way you think about your decisions now? Why? ANSWERS VARY.

- Can you write down a plan for your decisions to help you remember what you should think about? Draw your own thinking map and use some words that you learned in this lesson.

APPLYING THINKING

Immediate Transfer

- Later in the chapter, we found out that Fern's younger brother saw the runt pig at breakfast the next morning and asked for a pig to raise, too. Use your plan for decision making and decide what is the best thing for Mr. Arable to do.

- Think about the decision you discussed with your partner before we talked about Mr. Arable. Think through that decision using your decision-making plan. Would your decision now be the same as the one you made earlier? Why or why not?

Reinforcement Later

Later on in the school year, introduce additional transfer activities.

- In social studies, we've been studying about the Pilgrims' decision to leave Europe and come to the New World. Use your plan for decision making to think through whether or not they should leave Holland.

- We will be studying about pollution in science. Litter in the school is one type of pollution. Use your plan for decision making to think about how to keep the school free from litter.

- Think about a decision that you have to make sometime soon. Use your plan for decision making to think it through the same way. How can you remind yourself to think about decisions in this way when you have to make them? SUGGESTION: Write a note to yourself.

ASSESSING STUDENT THINKING ABOUT DECISIONS

To assess student thinking about decisions, ask students to consider the school littering problem, or ask them to think through a personal decision. Ask your students to make their thinking explicit as they consider the best option. Determine whether they are attending to each of the steps in the thinking map for decision making.
Sample Student Responses: Mr. Arable and the Runt Pig

SKILLFUL DECISION MAKING

OPTIONS
What can Mr. Arable do?

- Raise the pig himself.
- Give the pig away.
- Sell the pig.
- Give the pig to Fern to raise.
- Feed it steroids.
- Donate the pig to a science class.
- Find someone to take the pig.
- Give Fern all the facts and let her make the decision.
- Go ahead and kill it.
- Trade it with someone for something else of value.
- Donate the pig to someone outside the family to raise (farmer, 4-H, FFA).
- Make it into a pet.
- Do nothing; let the pig stay in the litter.
- Explain the effects on the pig, the litter, and the family to Fern, and then kill it.
- Turn the problem over to Mrs. Arable.
- Abandon the pig in the woods.
- Kill it after Fern has gone to school, and tell her it ran away.
- Postpone making a decision.

OPTION CONSIDERED
Give the pig to Fern to raise.

CONSEQUENCES
What will happen if Mr. Arable takes this option?

- Fern will feel relieved.
- Fern will feel that her father listens to her and will become closer to him.
- After awhile, Fern will stop caring for it.
- Fern will grow to love it and become attached to it.
- The pig will die anyhow.
- Fern will learn that Mr. Arable was right: it takes time and effort to raise a runt pig.
- The pig will grow up to be small.
- Fern will neglect other chores on the farm.

SUPPORT
Why do you think the consequence will occur?

- Fern cared about the pig and was upset that it would be killed.
- She was the only one who spoke on behalf of the pig to Mr. Arable; he took her feelings seriously.
- Raising runt pigs requires time and care. Fern is young and seems impulsive but cares about the pig.
- Fern is young, cares a lot for the pig, and feels strong emotions.
- It's hard to raise a runt pig. However, it isn't ill, and Fern will give it special attention.
- Fern is intelligent, observant, and interested in the pig, but small baby animals need much care.
- Smaller baby pigs usually make small adults.
- Fern's age, school work, and chores probably don't leave much time for the pig. However, she is concerned and seems responsible.

VALUE
How important is the consequence? Why?

- Important. Feelings are important but are short term results.
- Very Important. The relationship between a father and daughter is long term. Love is most important.
- Important. She may feel guilty, but may also learn from this.
- Very Important. Loving is the most important relationship.
- Important. The pig is a living being and life is important, but it would not have died of neglect.
- Very Important. It is valuable to learn the realities of farm life and respect for her father's opinions.
- Not Very Important. Small pigs bring less money, but size can be overcome.
- Important. Fern's help on a family farm is important but not necessary.

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### Sample Student Responses: Mr. Arable and the Runt Pig

#### SKILLFUL DECISION MAKING

**OPTIONS**

<table>
<thead>
<tr>
<th>Raise the pig himself.</th>
<th>Donate the pig to someone outside the family to raise (farmer, 4-H, FFA).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Give the pig away.</td>
<td>Make it into a pet.</td>
</tr>
<tr>
<td>Sell the pig.</td>
<td>Do nothing; let the pig stay in the litter.</td>
</tr>
<tr>
<td>Give the pig to Fern to raise.</td>
<td>Explain the effects on the pig, the litter, and the family to Fern, and then kill it.</td>
</tr>
<tr>
<td>Feed it steroids.</td>
<td>Turn the problem over to Mrs. Arable.</td>
</tr>
<tr>
<td>Donate the pig to a science class.</td>
<td>Abandon the pig in the woods.</td>
</tr>
<tr>
<td>Find someone to take the pig.</td>
<td>Kill it after Fern has gone to school, and tell her it ran away.</td>
</tr>
<tr>
<td>Give Fern all the facts and let her make the decision.</td>
<td>Postpone making a decision.</td>
</tr>
<tr>
<td>Go ahead and kill it.</td>
<td></td>
</tr>
<tr>
<td>Trade it with someone for something else of value.</td>
<td></td>
</tr>
</tbody>
</table>

**OPTION CONSIDERED**

Kill it after Fern has gone to school and tell her it ran away.

#### CONSEQUENCES

**What will happen if Mr. Arable takes this option?**

- Fern will find out and will lose trust for her father.
- Fern will learn to lie.
- Fern will fear for her own safety.
- Future communication with her father will be changed.
- Mr. Arable will feel guilty.
- Fern will not find out and will forget about it.
- Fern will cry.
- The problem of caring for the runt pig will be solved; time and effort will be saved.

#### SUPPORT

**Why do you think the consequence will occur?**

- Fern is persistent, observant, and emotionally attached to the pig.
- Fern is young but is sensitive to right and wrong.
- Fern is young and she feels a kinship with the pig, but her father has a caring relationship with her.
- Fern and her parents seem to be honest with each other. Lying and distrust limit communication.
- Mr. Arable spoke honestly with Fern and seems sensitive.
- Although Fern is young, she may not forget about something that she is so upset about.
- Mr. Arable’s experience raising pigs lets him understand the likelihood of survival and requirements for care.

#### VALUE

**How important is the consequence? Why?**

- Very Important. Fern’s relationship with her father is lifelong and very important for her development.
- Important. People won’t trust her.
- Important. Can cause fright and distress.
- Very Important. Communication is important in a family.
- Important. Mr. Arable may feel uncomfortable about it.
- Important. She will be satisfied, and she will no longer challenge Mr. Arable.
- Not Very Important. She may be unhappy, but she will get over it.
- Important. Effort and time are costly on a small farm. It may save the family from having to make sacrifices later.
### ALTERNATIVE ENERGY SOURCES

**Science**

**Grades 5-6**

#### OBJECTIVES

**CONTENT**

Students will learn how energy can be derived from the major alternative energy sources; they will learn of the availability, renewability, and environmental impact of these energy sources.

**THINKING SKILL/PROCESS**

Students will learn to consider options and their consequences and the importance of these consequences in making decisions. Students will also recognize the need for reliable information in making decisions.

#### METHODS AND MATERIALS

**CONTENT**

Students will use textbook material on the subject of alternative energy. This lesson includes a research option in which students gather reliable information about alternative energy from a variety of sources.

**THINKING SKILL/PROCESS**

Structured questioning about options and consequences and the use of a data matrix guide students through the decision-making process. (See pp. 39–43 for reproducible diagrams.) Collaborative learning groups brainstorm options and consequences.

#### LESSON

**INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS**

- Usually when we are trying to figure out what to do, we try to choose the best thing among a number of alternatives. If your parents are planning a vacation, they may compare and contrast a number of options, such as going on a trip, going to a resort, visiting relatives, and staying home. When they think about vacation possibilities, they take account of relevant factors like cost, travel time, etc. Of course they want to make sure they are getting accurate information about these factors so that they can make a good choice. How might they get accurate information about the cost of the trip?

- As your parents think about the consequences, they usually weigh their importance. For example, going to a quiet restful spot may be more important than the cost of taking a trip. They note which consequences count in favor of (pro) or against (con) their options. If they then pick the vacation that seems to be the best one based on this process, their decision is well thought out. The thinking map for decision making (at right) provides a list of things a person should think about in making a decision.

- Good decision making is especially important when it comes to decisions our country has to make about issues that affect all of us. One such decision involves the energy source our country should rely on. This decision should be based on scientific facts. Let's think about this

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<table>
<thead>
<tr>
<th>Skillful Decision Making</th>
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</thead>
<tbody>
<tr>
<td>1. What makes a decision necessary?</td>
</tr>
<tr>
<td>2. What are my options?</td>
</tr>
<tr>
<td>3. What information is there about the consequences of each option?</td>
</tr>
<tr>
<td>4. How important are the consequences?</td>
</tr>
<tr>
<td>5. Which option is best in light of the consequences?</td>
</tr>
</tbody>
</table>
```
issue according to our plan for making good decisions. Ask the students to review what they have studied about energy, in general, and about alternative sources of energy, in particular.

THINKING ACTIVELY

- Why are people today concerned about energy? Can you remember a time when you heard someone discussing this question? What made them concerned about it? POSSIBLE ANSWERS: We use a lot of energy. We rely on oil for our main energy needs, and the supply of oil may run out sometime within the next fifty years. We depend on oil from other countries, and some of those countries have closed off our oil supply in the past. We’ll be needing more energy in the future. Pollution affects our health and the environment. Oil can be used in more valuable ways. The price of oil continues to go up.

- What are some of our options regarding energy sources? Which should be our major source? We now rely on oil. Maybe oil should still be our dominant source. However, let’s think about other possibilities and try to decide which is best. Work together in groups of four and list as many energy sources as possible. Try to include some that are unusual. Think about how energy is produced from each source. Ask the groups to report at random but to mention only one energy source from their lists. Then ask for sources that haven’t been mentioned, creating a list from as many students as possible. Write the energy sources on the chalkboard or on a transparency under the heading “Options.” When uncommon sources are mentioned, ask if anyone knows how energy is produced from those sources. This taps students’ prior knowledge and contributes to the collaborative nature of the activity. POSSIBLE ANSWERS: Nuclear power, wind, water power from dams, solar power, burning garbage, ethanol from grain, the tides, heat from the earth (geothermal), magnetism, lightning, animal power, human power, wood, oil, coal, methane gas, natural gas, steam, gravity, and chemical reactions (batteries).

- When you are trying to make a complicated decision like this one, it’s a good idea to think about what information you might need in order to decide. What would you want to know about the consequences of relying on each of these energy sources? Make a list of the things you need to know about a type of energy in order to decide whether it is a good source for our country to rely upon. Your list might include, for example, how easy it is to produce the energy. What else would you add? The students should work in groups again and then report. Write student responses on the chalkboard or a transparency with the heading “Factors to Take into Account.” POSSIBLE ANSWERS: Costs (production, transportation, storage, distribution, finding the source, and research), availability, safety for workers in producing the energy, environmental pollution, how long it will last, cost to convert to a new energy source, public acceptance, cost of the energy, technology needed to produce and transmit the energy, whether the source is renewable, jobs lost or created, ease of use, consumer comfort, ease of production, public acceptability.

- Each group should now pick two sources from its list of options. Gather information about the consequences of relying on these different forms of energy with regard to the factors you have listed. You’ll use diagram called a “data matrix,” which is a chart having columns and rows. Write the energy forms down the side under “options,” and write the factors to consider across the top. Get the appropriate information from your textbooks or other sources to fill in the boxes. If you don’t have information, if you have only partial information, or if you’re not sure about its reliability, put a question mark in the cell. Write your unanswered questions on the lines below the diagram. (See the sample matrix p. 62.)

Allow sufficient time for your students to complete this activity. If they only use their textbooks, they can finish it within the class period. To include outside research (e.g., using resources in the school library) extend this lesson over additional class sessions.
• What does this information about the consequences of using these energy sources show about the options? Put a plus next to the factors that you think count in favor of choosing the energy source and a minus next to those that count against choosing it. Put a circle around the factors you think are more important than the others. For each entry, explain why you put a plus, a minus, or a circle. ANSWERS WILL VARY. Ask each group to report its findings to the rest of the class and explain why they rated the consequences as they did. Make a “class matrix” on the chalkboard or on a large piece of poster board. Fill in the matrix based on the reports of each group. Encourage students to add information from the group matrix to their individual ones. More than one copy of the matrix can be used if students need more space.

• Work together in your groups and decide what you would pick as the best source of energy for this country to rely upon, given the information on the chart. Discuss why it is the best energy source. Ask students to attend to the following questions as they make their decisions:

  What important unanswered questions do you have?

  In the light of these unanswered questions, how certain are you about your decision? Why?

  Ask each group to prepare an oral or written recommendation explaining the reasons for their choices. To make this lesson an ongoing research project, students should continue to gather information to answer their unanswered questions and periodically report their findings. Ask students to think about how they might get answers to their questions and then to develop a plan for gathering this information. Sources may include libraries, governmental agencies that deal with energy, TV documentaries, etc. When they get additional information, students may add it to their diagrams and report it to the class. Encourage them to reconsider their recommendations in the light of new information. A diagram may also be kept on a bulletin board for students to fill in.

THINKING ABOUT THINKING

• How did you go about thinking through your decision? Describe what you did first, next, etc. Draw a diagram that represents a flow chart of your thinking. Ask students to display their
decision making.

- Were there any aspects of this activity that you found particularly hard? Why? How might you do this more easily next time? ANSWERS WILL VARY.

- What do you think about this way of making a decision? Is this a good way to do it? What are some of its pros and cons? Discuss this strategy with the class and ask students whether the pros outweigh the cons or whether there is some better way to make a decision. POSSIBLE ANSWERS:
  
  **Pros:** Helps us think about wider energy options, reduces narrow thinking, presents an organized way to think about a complex subject, improves confidence in choices, encourages active involvement in the topic, makes us aware of the important information in determining desirability of relying on the source, makes it possible to record relevant information in an organized way so that we won’t forget it and can compare different options easily.

  **Cons:** Takes longer, requires that we write on the diagram the information we find, depends on the reliability of the information we are using.

Most students favor this approach for important decisions, though many say that it is too much trouble for decisions that are not too important. They still favor a shorter version of this strategy for even these choices—one that involves taking time to think about options and consequences prior to the decision.

- What plan for careful decision making works best for you? Allow students to map out their own plan for skillful decision making. If they omit one of the five attention points, suggest that they include something comparable. Students may include any points that they think will help them avoid difficulties they may have encountered with the energy activity.

- How does this compare to the way you ordinarily make decisions? What’s a good way to make sure that you follow this new plan instead? Students sometimes suggest writing down their plan in their notebooks or thinking portfolios or posting it on the wall of their classroom.

**APPLYING YOUR THINKING**

**Immediate Transfer**

- Select a decision that you are trying to make right now or that you will have to make soon. Think it through, following the plan for decision making you just developed. List any unanswered questions that you may have so that you can continue to think about your decision making and research it after you leave class. After you reach a decision, indicate how confident you feel about it, based on the questions you’ve been able to answer through your research.

- Imagine that your parents are considering whether they should use alternative energy sources in their apartment or home. Help them decide by using your decision-making strategy.

**Reinforcement Later**

Later in the school year, introduce reinforcing activities.

- As we study the atmosphere of the earth, we will find out that it is polluted with many different particles and chemicals. Decide what to do about some types of this pollution.

- As we study endangered species, select one endangered animal and recommend what to do to prevent its extinction.
We will be studying the way many immigrants came to this country from Europe in the early years of this century. Suppose you were a senator living at the time. What immigration policy would you support in Congress? Why? Use your decision-making strategy to decide what you think is the best thing to do. Would you support the same policy with regard to the Asians and Latin Americans who wish to immigrate to this country now? Explain why or why not.

**SKILL EXTENSION: DETERMINING THE RELIABILITY OF SOURCES**

Read an advertisement about nuclear power. What does it tell us about nuclear power? What would you want to find out about the advertisement and its source to help you determine whether or not the information it includes is reliable? Make a checklist of things that you might find out that would help you decide whether or not the information given in the advertisement is reliable. How could you get this information? Try to get this information so that you can judge whether the ad information is likely to be reliable.

Now think about whether the ad leaves unanswered any questions you have about nuclear power. If so, pick two of these questions. How could you get additional, reliable information to answer your unanswered questions? List some sources you think will be reliable and some that you are not sure about. Explain why you think they are or are not reliable.

**ASSESSING STUDENT THINKING ABOUT DECISIONS**

To assess this skill, ask students to write about any of the application questions. For example, ask them to think through a personal decision or to write about a controversial social issue, such as disposing of hazardous waste or environmental pollution. You may ask a similar question about a major historical decision, like Lincoln’s decision to issue the Emancipation Proclamation (making sure that students have enough background knowledge to answer it). Their writing can be in the form of a standard essay, a recommendation to someone, or a letter to the editor of a local newspaper. Ask students to make their thinking explicit in their writing. Determine whether they are attending to each of the steps in the thinking map for decision making.

If you choose the extended form of this lesson, in which students gather additional information and periodically return to the question, you can use portfolio assessment techniques. Ask your students to state their learning and thinking goals in this activity and to include their comments in a special portfolio for this project. They should include products in their portfolios that indicate how well they are making these goals (filled-in matrices, notes on energy sources from their research, their written recommendations, etc.). They should comment on how well they believe they are meeting their goals, both with regard to gathering information about energy sources and in their decision making. The students should include these comments in their portfolios.
## DECISION-MAKING MATRIX

### OPTIONS

<table>
<thead>
<tr>
<th>OPTIONS</th>
<th>EASE OF PRODUCTION</th>
<th>RELEVANT CONSEQUENCES</th>
<th>COST</th>
<th>AVAILABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOLAR</td>
<td>Easy, if location, latitude, and weather conditions are favorable. Little maintenance. Limited service for repairs.</td>
<td>No undesirable air or water pollution. Unsightly equipment or circular fields of mirrors. Loss of trees.</td>
<td>Start-up is costly (could be reduced by mass manufacture). Low maintenance and repair. Operation costs are minimal.</td>
<td>Limited by location, latitude, and weather. Seasonal in some areas. Distribution of resulting electricity limited. Renewable.</td>
</tr>
<tr>
<td>NUCLEAR</td>
<td>Complex, requiring sophisticated instruments, specialized technicians, and unusual safety measures. Waste disposal is risky and requires long-term safeguards.</td>
<td>Radiation danger. Mining erosion, toxic tailings to secure uranium Storage of waste may result in radioactive contamination. No atmospheric pollution when operating normally.</td>
<td>Protective measures in operation and start-up costs are high. Licensing, certifying, and inspecting plants are expensive. Lower costs to consumers in some regions.</td>
<td>Uranium is scarce. Breeder reactors are controversial and limited in number.</td>
</tr>
<tr>
<td>PETROCHEMICAL</td>
<td>Complex, but commonly practiced.</td>
<td>Oil spills may result. The oil supply may be depleted. Hydrocarbons pollute the air, damage the ozone layer, and create acid rain. Processing pollutes air.</td>
<td>Exploration, research, distribution and clean-up costs are high. Importing is costly and depends on international pricing. It has value for uses other than energy.</td>
<td>Limited regional supplies. Non-renewable.</td>
</tr>
<tr>
<td>COAL</td>
<td>Complex, but commonly practiced.</td>
<td>Strip- and shaft-mining scar the land. Use creates a grey film on surfaces. Particulate emissions pollute the air. Acid rain pollutes air and water.</td>
<td>Research and development of soft coal use is costly. Labor, transportation, and conversion are costly.</td>
<td>Diminishing supply. Soft coal underutilized.</td>
</tr>
</tbody>
</table>
# Decision-Making Matrix

## Options

<table>
<thead>
<tr>
<th>OPTIONS</th>
<th>EASE OF PRODUCTION</th>
<th>ENVIRONMENT</th>
<th>COST</th>
<th>AVAILABILITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tidal Power</td>
<td>Easy, if location and weather conditions are favorable. Technology not well developed.</td>
<td>No undesirable air or water pollution. Unsightly. Plant and animal life affected. Rivers altered.</td>
<td>Start-up is costly. Operation costs are minimal. Technology is not well developed; research may initially be costly.</td>
<td>Limited by location. Distribution of resulting electricity limited.</td>
</tr>
<tr>
<td>Wind Power</td>
<td>Easy, if location and weather conditions are favorable. Use in large numbers may reduce efficiency due to interference of air between units.</td>
<td>No undesirable air or water pollution. Unsightly. Noisy equipment or fields of windmills.</td>
<td>Start-up can be costly (could be reduced by mass manufacture). Low maintenance and repair costs. Conversion costs for home or industrial use may be considerable.</td>
<td>Limited by geographical location and weather. Distribution of electricity is limited. Large number of units required for relatively little power.</td>
</tr>
<tr>
<td>Burning Garbage</td>
<td>Easy to make anywhere.</td>
<td>Reduce/recycle landfills. Air emissions with current technology undesirable.</td>
<td>Start-up is costly using current technology.</td>
<td>Raw material is available everywhere there are people to use the power.</td>
</tr>
</tbody>
</table>
## Decision Making Matrix

### Options

<table>
<thead>
<tr>
<th><strong>ABUNDANCE/RENEWABILITY</strong></th>
<th><strong>ACCESSIBILITY</strong></th>
<th><strong>COST OF PRODUCTION</strong></th>
<th><strong>COST TO CONSUMERS</strong></th>
<th><strong>SAFETY</strong></th>
<th><strong>ENVIRONMENTAL IMPACT</strong></th>
<th><strong>EASE OF CONVERSION</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OIL</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. has less than a decade of oil reserves left. Oil is non-renewable, therefore worldwide resources are also being depleted. Reserves can run out.</td>
<td>Oil is hidden underground. More than 50,000 oil wells are drilled in U.S. alone. New oil reserves are getting very difficult to discover; locating oil will get even tougher in the future.</td>
<td>20 billion dollars was spent in 1980 to gasify coal.</td>
<td>Petroleum products (primarily oil and gas) are usually readily available to consumers around the world. It is mostly affordable.</td>
<td>Petrochemicals are flammable and toxic. Gas can escape. Combustion and transport risks are increased demand for oil and oil products may multiply safety risks.</td>
<td>Combustion of fossil fuels produces airborne pollutants, oil seepage and spills into the ground and onto oceans can threaten life. Increased use of oil will increase damage to the environment.</td>
<td>Minimal: most vehicles have internal combustion engines, many homes have furnaces that can be easily converted to oil. Distribution of fuel oil and gas is already at the neighborhood level, so it will remain so.</td>
</tr>
<tr>
<td><strong>NATURAL GAS</strong></td>
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<td></td>
</tr>
<tr>
<td>U.S. has substantial reserves of natural gas but much of it lies in places which are uneconomical to develop. But LNG is available from Arab nations and it is also possible to gasify coal. Gas may be available for the long haul.</td>
<td>Only about one fourth of all wells drilled are for gas. Unconventional sources like &quot;tough sands&quot; need to be fracturing with high pressure liquids. As supply dries up, these less accessible sources will have to be tapped.</td>
<td>Natural gas does not have to be refined and is therefore not much at present but if demand increases, non-conventional and costly sources such as &quot;tough sand&quot; and shale deposits will have to be used.</td>
<td>In the United States, natural gas is readily available to consumers in developed areas. Average supply in low in cost. The technology to get it to consumers has been in use for many years.</td>
<td>Natural gas is very clean. Leaks into the atmosphere are relatively rare. Increased use should not impact negatively on the environment. Beyond the addition of more drill rigs throughout the U.S.</td>
<td>Natural gas is very clean. Leaks into the atmosphere are relatively rare. Increased use should not impact negatively on the environment. Beyond the addition of more drill rigs throughout the U.S.</td>
<td>Natural gas burns very cleanly. Leaks into the atmosphere are relatively rare. Increased use should not impact negatively on the environment. Beyond the addition of more drill rigs throughout the U.S.</td>
</tr>
<tr>
<td><strong>COAL</strong></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Coal is the most plentiful fossil fuel and the U.S. has about 25% of the world's supply. There is enough coal in the world to last for at least 200 years and maybe ten times longer. There is enough for the long haul.</td>
<td>Coal has to be dug out of the ground. 45% is dug out of deep mines; the rest from surface strip mines. Much coal is so deep that it is economically extracted. Increased demand could require developing new mining technology.</td>
<td>Most coal is not refined and is delivered directly to utility plants. Therefore, once out of the ground, the coal is very low in cost. The transportation technology to get it to consumers is simple and has been in use for many years.</td>
<td>Even though it is no longer widely used in the United States, coal is available to consumers and very low in cost. The transportation technology is simple and has been in use for many years.</td>
<td>In a typical year 100 miners die and 1000's are injured. However, although coal is combustible it is not co-positively flammable or dangerous to transport or deliver. But increased use would increase pollution.</td>
<td>In a typical year 100 miners die and 1000's are injured. However, although coal is combustible it is not co-positively flammable or dangerous to transport or deliver. But increased use would increase pollution.</td>
<td>Smokestack emissions from coal burning industries can be reduced by rail. Internal combustion engines and home heating systems must be changed and a new means of delivery provided.</td>
</tr>
<tr>
<td><strong>GEO- THERMAL</strong></td>
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</tr>
<tr>
<td>Geothermal energy is plentiful, 2,000,000 exploitably acres are now being explored and developed. There may be enough for the long run if new technology is developed to get at it.</td>
<td>Little geothermal energy can be used. In most of the U.S. a significant temperature gradient exists, but very low for practical use. However, the West and the eastern seaboard are ideal areas for development.</td>
<td>The cost of developing new technologies to reach and use deep lying geothermal energy sources such as hot water, steam and magma are enormous. If demand increases, cost will skyrocket.</td>
<td>Geothermal energy is used to heat water. The water is collected and the heat is stored and used to heat water. The heat is used to produce steam and is not available, hence the geothermal technology makes it costly.</td>
<td>There are no substantial dangers associated with the use of geothermal energy. Production of electricity from steam and hot water is already safe.</td>
<td>There are no substantial dangers associated with the use of geothermal energy. Production of electricity from steam and hot water is already safe.</td>
<td>Easy to heat with warm water but impractical to replace the gasoline engine with portable steam. Would have to build new power plants, produce electricity from steam and replace the gasoline engine with batteries.</td>
</tr>
</tbody>
</table>
THE CANALS OF MARS

OBJECTIVES

CONTENT
Students will learn about the surface of the planet Mars and will learn how astronomical observations are made.

THINKING SKILL/PROCESS
Students will learn how to make judgments about the accuracy and reliability of observations based on the presence or absence of relevant factors.

METHODS AND MATERIALS
Students read an observation report about the planet Mars written by an astronomer. They pose questions about their background knowledge about instruments of observation in astronomy, in particular telescopes. They also read other reports about Mars.

THINKING SKILL/PROCESS
An explicit thinking map, a graphic organizer, and a structured questioning emphasize factors which influence the reliability and accuracy of an observation. (See pp. 348-352 for reproducible diagrams.) Collaborative learning enhances the thinking.

LESSON

INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS

• Have you ever heard an account of an event that you accepted as accurate, but later found out that it wasn’t? Jot down some of the details of that situation. Now tell your partner about it. What went wrong with the account that made it incorrect? Get three or four reports from students and write on the chalkboard their diagnoses of what went wrong with the reports. POSSIBLE ANSWERS: It was based on rumors. It was a deliberate distortion for some ulterior motive. It was advertising to sell something. It was in a sensationalist newspaper. The person who gave the account got information that was inaccurate from someone else and didn’t know it. The person made a mistake in what he thought he saw because he was distracted.

• Since we rely so much on information from others, it is important to make sure that we get accurate information. We make decisions about purchases based on information we get from others. We find out how to do things, as in sports, based on information we get from others. Think about all the different sources of information you use. Jot down a few of them. POSSIBLE ANSWERS: Newspapers, TV news, textbooks, teachers, salespeople, friends, dictionaries, telephone books, TV documentaries.

• In this lesson we will find out how to determine beforehand whether information we’re getting is coming from a reliable source. We will examine a special kind of information—information that we and others get from observation.

• Science is one field in which we rely on observation to give us basic information. Whenever we conduct an experiment, we record our observations. Even complicated scientific theories are based on observation. What you read in your textbook about the planets is based on observations that people have made. We’re going to look at some observations made by a scientist who drew some pretty startling conclusions. We’re going to think about how to decide whether the observations are accurate.
THINKING ACTIVELY

• Read the following illustrated description written by someone who was interested in the planets and who decided to observe them to find out what they were like. This is his description of what he saw when he looked at the planet Mars.

15 July—I was amazed to see dark areas of blue-green that exactly typify the distant look of our own forests. Only a few months ago this area was pale yellow in color, suggesting the seasonal changing color of leaves. A projection stood out from the planet’s surface, but it was clearly not a mountain peak, since the projection was not fixed in place, but suggested a cloud formation. The most startling observation of all was that of miles and miles of parallel lines, so geometrically regular that I am at a loss to show their ruled effect in my drawing. I’m certain that these bizarre parallel features are canals, laid down with as much precision as railway metals on Earth. Only intelligent life could have constructed such canals!

• What reaction do you have to this? POSSIBLE ANSWERS: I didn’t know there was life on Mars. I wonder what the canals do. This must be science fiction.

• Let’s think about this. Sometimes, great discoveries sound fantastic. On the other hand, sometimes reports like this are wrong. How can we tell? It’s clear that this person is telling us about life on Mars is not something he observed directly. Rather, he is saying this because of his observation of canals on Mars, something he thinks only intelligent beings could construct. So let’s think about this observation. How can we tell if it is accurate? Work together in groups of three or four to make a list of questions you would like to have answered to help you decide whether this report is accurate and reliable. List questions you would ask about the source and circumstances, as well as questions about the report. Use the diagram for questions about the reliability of sources for your list of questions. Write them on the dotted lines on the left. When the students have worked for about five minutes, ask them to report. Ask each group to mention one question, so that all the groups respond. List the questions on a large “class” diagram that you construct on the board or on a transparency. Then ask if students have any other questions that haven’t been mentioned. Add those to the diagram.

• We could try to answer these questions one by one, but perhaps there is a more organized way to do this. If we group questions, we can make a checklist of types of things we want to find out about the source. This will help us decide whether or not he or she is a reliable and accurate

observer. Group these questions together into a few basic categories, such as questions about the observer. Write these categories on the short lines on the top of the diagram and connect the appropriate questions to the dotted line that leads to it. Call for responses and write them on the class diagram. POSSIBLE ANSWERS: The observer, how the observation was conducted (including the equipment and its condition), the report itself, corroboration.

- Let’s try to organize these types of questions and construct a thinking map that we can use to determine the accuracy of an observation. We can use the map as a checklist for making these kinds of judgments. Add relevant subcategories under each major heading. The list that students develop may resemble the thinking map shown at the right.

- Now let’s go back to the report on the canals of Mars and try to answer some of these questions. Here’s the title page of a book that the observer wrote about the canals of Mars and some additional biographical data about the observer. (Make available copies of pages 366–67). What information does this material provide that answers questions on your list? Record your results on this graphic organizer, “Determining the Reliability of Sources.” Ask students to read some of the recorded answers to their questions. POSSIBLE ANSWERS: The observer had the background and training to be a good astronomical observer. He was well qualified (professor at M. I. T.). He won many prizes, hence probably had a good reputation as an astronomer. He wrote Mars and Its Canals in 1906 — before scientists had the sophisticated technology that we do now for observing planets. He used a large telescope for his time. He made many observations. He wrote this passage in his journal while he made the observation. He believed that canals were there before he looked through his telescope, perhaps creating a predisposition to believe this. There is no evidence of drinking or psychological disorder.

- Try to reach agreement in your groups about whether or not you believe that this is an accurate and reliable observation. Explain why. In the box on the right side of your graphic organizer, write whether the observation report is reliable, unreliable, or uncertain.

- Use your textbooks and other sources for more information about the surface of the planet Mars. What would this information show about the credibility of Lowell’s account? Is there any information that corroborates Percival Lowell’s observations? Is any of this information more acceptable than Percival Lowell’s report? Why? If you want to extend this activity, show students some of the Mariner photo...
graphs of Mars. These are contained in the book MARS, As Viewed by Mariner 9, published by NASA in 1976 and in other sources that are available at most libraries. Discuss with your students the differences in the technology and its reliability for the following circumstances: when a person observes Mars through a telescope on Earth, when photographs of Mars are taken through a telescope on Earth, and when a spacecraft near Mars sends back to Earth computer-enhanced pictures.

- Prepare a report about what you think the surface of Mars is like. Illustrate this report. Explain why you think this is an accurate description. What unanswered questions do you have about the surface of the planet? Discuss with students the planet’s surface features that might have made Percival Lowell think he was seeing canals.

THINKING ABOUT THINKING

- Let’s put aside these questions about Mars now. Think about how you developed your checklist of things to consider in determining the reliability and accuracy of an observation report. What did you think about first, and how did you proceed so that you had a good checklist? Answers should refer to listing the questions, categorizing them, and then transforming the categories into a checklist. Some students may also comment on the collaborative nature of the activity.

- Is that a good way to develop a checklist? Can you think of other situations for which this strategy would be helpful? Answers may refer to checklists for making purchases. You could make a list of questions you would want answered to help you decide what to buy and a list of sources to consult to answer these questions.

- Is the checklist you developed for judging the reliability and accuracy of an observation report a helpful one to use for this purpose? Why?

- What advice would you give to another person about how to make sure that his or her observation reports are as accurate and reliable as possible? Good advice includes using the checklist to plan how you are going to conduct and report on an observation.

APPLYING YOUR THINKING

Immediate Transfer

- Suppose you were going to visit a nearby pond in order to make observations about the natural behavior of animals that lived in and around the pond. Plan your observation so that you will bring back the most accurate observation reports you can. Write out your plan. Students should use the checklist and apply it to this specific observation.

- Suppose a car hit the side of a truck. Several people saw the accident. Which of the following witnesses do you believe would give you the most accurate and reliable account? Which the least? Why?
  - A man getting into a car on the other side of the street
  - A policewoman directing traffic at the next intersection
  - The driver of the truck that was hit
  - A three-year-old passenger in the back seat of the car that hit the truck
  - A man looking out of his window from a third-story window on the other side of the street
Reinforcement Later

When the class is studying the following topic later in the school year, ask the given questions.

- We are now studying the effects of diet on health. We’re going to look at various reports about diet and health in advertising, from health clinics, on milk cartons, etc. Apply your checklist to try to determine which of these is likely to be more reliable and accurate than others. What might you do to verify the information contained in these sources?

- We are studying the way of life of the Native Americans. Find four sources of information about the Native Americans. Use your checklist to decide which of these sources is likely to provide the most accurate and reliable information. Explain why. Compare these descriptions to your textbook and to a movie you’ve seen about the Old West. Describe two important things you’ve found out about the Native Americans in the Old West that you didn’t know before and that you think are accurate. List some things that you think are not accurate. Explain.

- Think about a purchase you will be making in the next few months. What sources would give you the best information for making a good decision? Why?

<table>
<thead>
<tr>
<th>ASSESSING STUDENT THINKING ABOUT RELIABLE SOURCES</th>
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<tbody>
<tr>
<td>Any of the transfer examples can serve as an assessment item. The example about the pond is particularly suited for this purpose. It can be used as pre- and post-tests to see whether the students have changed the way they make judgments about accuracy and reliability. Decide beforehand how many additional items from the checklist the student should mention in order to show improvement.</td>
</tr>
<tr>
<td>Here is an example of pre- and post-test responses that can be used as a paradigm for judging student improvement. In the pre-test, students were asked to plan an observation of animal behavior in and around a nearby pond. Student responses were predominantly like the following:</td>
</tr>
<tr>
<td>I would plan to look at things.</td>
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<tr>
<td>I would go there.</td>
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<tr>
<td>In the post-test given a few months after the Canals of Mars lesson, their responses included plans like the following, none of which were mentioned in the pre-test:</td>
</tr>
<tr>
<td>I would bring binoculars.</td>
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<tr>
<td>I would make sure I could get close enough to get a good view.</td>
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<tr>
<td>It would have to be daylight.</td>
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<tr>
<td>I would read up on what I was going to be observing beforehand so I knew what I was going to be looking at.</td>
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<tr>
<td>I would bring a pad and pencil and write down what I saw when it was happening.</td>
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<tr>
<td>I would bring someone along who would also take note of these things.</td>
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<tr>
<td>The post-test responses are more articulate than the pre-test responses. In this case, the scoring criteria for substantial improvement was that a student’s plans must include mention of one or two factors from each of the major categories on the thinking map. These responses clearly show improved judgment about determining the reliability of an observation.</td>
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Sample Responses • The Canals of Mars

QUESTIONS ABOUT THE RELIABILITY OF A SOURCE OF INFORMATION

<table>
<thead>
<tr>
<th>QUESTIONS</th>
<th>TYPES OF QUESTIONS</th>
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<tbody>
<tr>
<td><strong>OBSERVATION</strong></td>
<td><strong>REPORT</strong></td>
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<tr>
<td>What is his background?</td>
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<td>What is his scientific reputation?</td>
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<tr>
<td>For whom was the report written?</td>
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<tr>
<td>What kind of equipment did he use?</td>
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<tr>
<td>Did he use the same equipment for all sightings?</td>
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<tr>
<td>What was his state of mind? Was he clear-headed?</td>
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<tr>
<td>Where was he when he made his observation?</td>
<td></td>
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<tr>
<td>Did other accounts corroborate his report?</td>
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<tr>
<td>In what form or publication did the report appear?</td>
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<tr>
<td>Was the report a translation or his own words?</td>
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<tr>
<td>What were the weather conditions?</td>
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<tr>
<td>In what year did he make the observation?</td>
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<tr>
<td>When did he write the report?</td>
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<tr>
<td>Did he have normal sight?</td>
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<tr>
<td>Was the equipment appropriately maintained?</td>
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<td>Was he typically trustworthy?</td>
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<tr>
<td>What did he expect to see?</td>
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<tr>
<td>Did he know how to use the equipment?</td>
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<tr>
<td>How often did he observe it?</td>
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<tr>
<td>Is the lens scratched?</td>
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<tr>
<td>How long did he observe it?</td>
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<tr>
<td>Did he believe in life on Mars prior to the observation?</td>
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<tr>
<td>Did he make accurate observations of other planets?</td>
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<tr>
<td>Was he drinking before he made the observations?</td>
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<tr>
<td>Was a model made to verify how formations should look?</td>
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<tr>
<td>Was he paid for this account? If so, by whom?</td>
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MARS

AND ITS CANALS

BY

PERCIVAL LOWELL

DIRECTOR OF THE OBSERVATORY AT FLAGSTAFF, ARIZONA; NON-RESIDENT PROFESSOR OF ASTRONOMY AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY; FELLOW OF THE AMERICAN ACADEMY OF ARTS AND SCIENCES; MEMBRE DE LA SOCIETE ASTRONOMIQUE DE FRANCE; MEMBER OF THE ASTRONOMICAL AND ASTROPHYSICAL SOCIETY OF AMERICA; MITGLIED DER ASTRONOMISCH GESELLSCHAFT; MEMBRE DE LA SOCIETE BELGE D'ASTRONOMIE; HONORARY MEMBER OF THE SOCIEDAD ASTRONOMICA DE MEXICO; JANSSEN MEDALIST OF THE SOCIETE ASTRONOMIQUE DE FRANCE, 1904. FOR RESEARCHES ON MARS; ETC., ETC.

ILLUSTRATED

New York

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1906

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Lowell's interest in Mars had begun late in the last century, when he became interested in reports of observations made in 1877 by Giovanni Schiaparelli, an Italian astronomer. Schiaparelli said he had seen faint lines on Mars, and he referred to them as canali. The popular British and American interpretation of the word canali was that it meant canals—which are, of course, man-made—rather than channels, which need not be. Nor did Schiaparelli make any attempt to clarify the interpretation; indeed, he once remarked; "I am very careful not to combat this suggestion, which contains nothing impossible"—a use of the double negative still favored by seekers after extraterrestrial life, particularly Sagan. (It is, of course, a not ungrammatical use of the double negative.) Schiaparelli, whose eyesight was failing, continued to observe Mars on its close approaches to the Earth until about 1890. (Mars and the Earth pass each other in their orbits about every 2 years. At these times, they are said to be in opposition; exceptionally close approaches occur every 16 years.) Lowell, who had exceptionally good eyesight and was proud of it, took up the watch in 1894, when he set up an 18-inch telescope on a hill, which came to be called Mars Hill, outside Flagstaff, Arizona; this was the genesis of the Lowell Observatory, one of the first in this country to be situated in a remote spot for good visibility, and today a major astronomical institution. Then, as now, Mars watching had its difficulties. When the planet was low in the sky, so that the telescope's eyepiece was high off the ground, Lowell had to hang from a ladderlike scaffold that lined the observatory walls like the stall bars of a gymnasium. On a drawing board hooked to a convenient rung, Lowell made sketches of his observations. In color, Mars was a brilliant, splotchy orange red, though there were some darkish blue-green splotches as well. In 1659 the Dutch astronomer Christian Huygens—the first man to study Mars telescopically—had discovered white splotches at either pole, which he deduced to be polar caps. The markings looked fuzzy and ill-defined, and they varied from time to time, the way a nearsighted man might view the image in a kaleidoscope; Mars had, in fact, the shifty splotchiness of a Rorschach inkblot, in which people are sometimes asked what they think they see.

During the next 20 years, Lowell concluded that Mars was laced with an elaborate webbing of canals, which, because of their extreme length, precision, and straightness, could have been created only by a highly advanced civilization. Lowell, who was as literate as Sagan (the poet Amy was his sister and his brother Abbott Lawrence was president of Harvard), recorded his observations in three very persuasive books. "Suggestive of a spider's web seen against the grass of a spring morning, a mesh of fine reticulated lines overspreads (the planet)," he wrote in Mars and Its Canals, which was published in 1906. "The chief difference between it and a spider's web is one of size, supplemented by greater complexity, but both are joys of geometric beauty. For the lines are of individually uniform width, of exceeding tenuity, and of great length. These are the Martian Canals."

STAFF-DEVELOPMENT SEMINAR
ACTIVITY MATERIALS

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# Observation/Coaching Guide for Infusion Lessons

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## INFUSION LESSON PLAN

### OBJECTIVES

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### METHODS AND MATERIALS

### LESSON

#### INTRODUCTION TO CONTENT AND THINKING SKILL/PROCESS

**INTRODUCTION**

1. Importance of the thinking
2. How do you do the thinking
3. Importance of the content

#### THINKING CRITICALLY

...
APPLYING THINKING

1. Kind of thinking?
2. How did you do it?
3. Is it effective?

EXTENSION ACTIVITY (optional)

ASSESSING STUDENT THINKING
<table>
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<th>FOUR COMPONENTS OF INFUSION LESSONS</th>
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<td>The Bombing of Hiroshima (Clear Delineation of the Four Components)</td>
<td>Mr. Arable and the Runt Pig (Verbal and Graphic Organizers)</td>
<td>Henny Penny (Identifying a Type of Thinking, Questions at Three Levels of Metacognitive Awareness)</td>
<td>The Canals of Mars (Near and Far Transfer Examples, Reinforcement Suggestions)</td>
<td>Lincoln and Douglass (Variety of Methods, Including Cooperative Learning)</td>
<td>Alternative Energy (The Interweaving of Teaching for Thinking Skill Objectives and Content Objectives)</td>
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INFUSION WORKSHOP SERIES
PLANNING FORM

GOALS:

AUDIENCE:

TIME FRAME/STRUCTURE:

SKILLS COVERED:

MAJOR THEMES:

WORKSHOP LEADERS/COACHES:

MATERIALS NEEDED:
INFUSION WORKSHOP SEGMENT
PLANNING FORM

INTRODUCTION:

DEMONSTRATION:

COMMENTARY:

ADDITIONAL EXAMPLES OF LESSONS ON THE SAME SKILL/PROCESS:

PARTICIPANTS IDENTIFY CONTEXTS IN THEIR OWN TEACHING FOR SIMILAR LESSONS