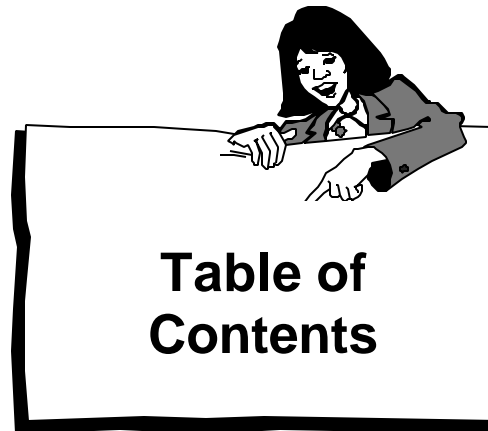


What is HOT?

Higher Order Thinking

Louisiana Teacher Assistance and Assessment Program

May 1996
Revised July 1998, 1999, 2000



Relevance of Higher Order Thinking

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The griney
grollers
grangled in the
granchy gak.

The Griney Grollers Thinking Skills Test

1. What kind of grollers were they?
2. What did the grollers do?
3. Where did they do it?
4. In what kind of gak did they grangle?
5. Place one line under the subject and two lines under the verb.
6. In one sentence, explain why the grollers were grangling in the granchy gak. Be prepared to justify your answer with facts.
7. If you had to grangle in a granchy gak, what one item would you choose to have with you and why?



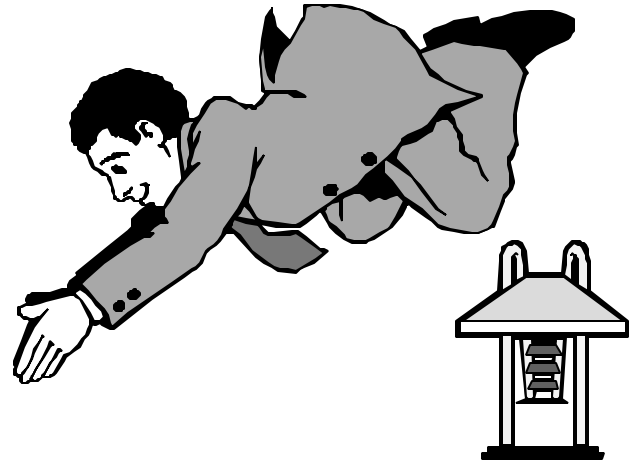
Moral:

Students can answer low-level questions without thinking.

Students enter/exit classrooms with no more understanding of what they've learned than "The Griney Groller" taught you!

So... let's dive right in!

By the end of this session, you will be able to do the following:



1. Define higher level thinking.
2. Plan for higher level thinking instruction.
3. List the materials, questions, inferences, and conclusions involved in choosing higher level instruction strategies.
4. Identify ways higher level thinking components can be used in the classroom.

LOUISIANA TEACHER ASSISTANCE AND ASSESSMENT INSTRUMENT

PREOBSERVATION INTERVIEW RECORD

DOMAIN I: PLANNING

COMPONENT A: TEACHER PLANS EFFECTIVELY
FOR INSTRUCTION

- ATTRIBUTE IA1: Specifies Learner Outcomes in Clear, Concise Objectives
- ATTRIBUTE IA2: Includes Activity/Activities That Develop Objectives
- ATTRIBUTE IA3: Identifies and Plans for Individual Differences
- ATTRIBUTE IA4: Identifies Materials, Other Than Standard Classroom Materials, as Needed for Lesson
- ATTRIBUTE IA5: States Method(s) of Evaluation to Measure Learner Outcomes

LOUISIANA TEACHER ASSISTANCE AND ASSESSMENT INSTRUMENT

OBSERVATION RECORD

DOMAIN III: INSTRUCTION

COMPONENT IIIC: PROVIDES FOR STUDENT
INVOLVEMENT
ATTRIBUTE IIIC3: ENCOURAGES HIGHER-ORDER
THINKING

Assessor "Look Fors"

Teacher uses a variety of probing questions with provision of time for student responses. Use of higher-order activities (i.e., cooperative learning; critique of other's process, products, activities, or ideas; laboratory activities). Higher order is not restricted to older learner.

Observation Scripting Form
Attribute IIC3:

Teacher Questions/Activities



Factual Recall

Comprehension

Application

Analysis

Synthesis

Evaluation

TAXONOMY OF THE COGNITIVE DOMAIN (BLOOM, 1956)

Descriptions of the Major Categories in the Cognitive Domain

Knowledge. *Knowledge* is defined as remembering previously learned material. This process may involve the recall of specific facts or complete theories, but all that is required is the rote memory of the appropriate information. Knowledge represents the lowest and most basic level of learning. For example, reciting the Preamble to the Constitution is a knowledge-level outcome.

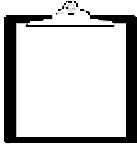
Comprehension. *Comprehension* is defined as the ability to understand the meaning of material. This process may be shown by translating material from one form to another form (words or numbers), by explaining material (interpreting or summarizing), by providing examples, or by estimating future trends (predicting consequences or effects). These learning outcomes go one step beyond the simple remembering of material and represent the lowest level of understanding.

Application. *Application* refers to the ability to use learned material in a new and concrete situation. This process may include the application of such things as rules, methods, concepts, principles, laws, and theories. As an example, most mathematics objectives which involve solving problems are at the application level.

Analysis. *Analysis* refers to the ability to break down a concept into parts. This process may include the identification of the parts and the analysis of the relationships between parts. Learning outcomes at the analysis level require an understanding of both the content and the structure of the material. As an example, asking students to compare and contrast two characters in a story is at the level of analysis.

Synthesis. *Synthesis* refers to the ability to form something new. This process may involve the production of a unique composition (theme or speech), a plan or proposal, or an original abstract idea. Learning outcomes in this area stress creativity and originality. A creative activity such as making a diorama is **not** at the synthesis level unless the intended outcome behavior involves creativity.

Evaluation. *Evaluation* is concerned with the ability to judge the value of a statement or some material such as writing, music, or art. The judgments are to be based on criteria, and the student may determine the criteria or be given them. The student must be able to justify the judgment based on the criteria of all of the other categories plus value judgments. An example of an evaluation-level outcome would be to require that the students judge whether a piece of poetry is a Shakespearean sonnet and be able to tell why or why not.



Thinking Words to Use in Assignments

Evaluation

appraise, choose, compare, conclude, decide, defend, evaluate, give your opinion, judge, justify, prioritize, rank, rate, select, support, value

Synthesis

change, combine, compose, construct, create, design, find an unusual way, formulate, generate, invent, originate, plan, predict, pretend, produce, rearrange, reconstruct, reorganize, revise, suggest, suppose, visualize, write

Analysis

analyze, categorize, classify, compare, contrast, debate, deduct, determine the factors, diagnose, diagram, differentiate, dissect, distinguish, examine, infer, specify

Application

apply, compute, conclude, construct, demonstrate, determine, draw, find out, give an example, illustrate, make, operate, show, solve, state a rule or principle, use

Comprehension

convert, describe, explain, interpret, paraphrase, put in order, restate, retell in your own words, rewrite, summarize, trace, translate

Knowledge

define, fill in the blank, identify, label, list, locate, match, memorize, name, recall, spell, state, tell, underline



The Pledge of Allegiance

Recall

1. Say the pledge.
2. Write the pledge

Comprehension

1. Say the pledge in your own words.
2. Give example of these words:
"pledge allegiance"
"indivisible"
"liberty and justice for all"
3. Write your own definition for these words.

Application

Analysis

Synthesis

Evaluation

HIGHER ORDER THINKING

HIGHER ORDER THINKING SKILLS¹

There are many ways of conceptualizing thinking skills, or higher order skills as they are sometimes called, and effective teachers address these essential skills in several ways in classrooms. While there is no one right way of describing how human beings think, the model used in the Louisiana Teacher Assistance and Assessment Program is that developed by Barry Beyer². Since the Beyer model has been chosen as a way of organizing our search for teacher efforts to bring about higher-order thinking in students, you should be familiar with the model and procedures that you can use to teach thinking--that's right--teach thinking. David Perkins (Howard University) has said:

Every day thinking, like ordinary walking, is a natural performance we all pick up. But good thinking, like running the 100-yard dash, is a technical performance. . .



Sprinters have to be taught how to run the 100-yard dash; good thinking is the result of good teaching, which includes much practice.

When an assessor observes in my classroom and talks with me in my preobservation interview, what evidences of planning for an instruction in higher-order thinking will (s)he be looking for?≡ That question is in the mind of every Louisiana new teacher. For the time being, simply keep in mind that evidence of instruction in thinking skills is most often found in a) the types of questions you ask students, b) the types of questions you get students to ask themselves, and c) the types of activities you use in the classroom. While there are many special programs available for teaching thinking, it is our belief that teachers don't have time to add more

¹ This module was prepared for the Louisiana Department of Education by Dr. Russell L. French, University of Tennessee, Knoxville.

² Beyer, Barry K. Developing A Thinking Skills Program. Boston: Allyn and Bacon, 1988.

programs to the classroom.



The best way to teach thinking is to teach it as part of mathematics and language arts and social studies and science and every other subject. We simply need to plan questions and activities that cause people to think, continually to practice thinking, and to examine their thinking and that of others.

In this module, you will have the opportunity to formulate questions guaranteed to cause thinking and to examine and plan classroom activities that are "higher order" in nature. But first, let's try to gain some understanding of Beyer's model, so that you and your assessors share the same definitions and understanding of higher-order thinking skills.

Beyer's Model

Byer suggests that human beings exercise three levels of cognitive activity (thinking). Level III, the foundational level is composed of eight microthinking skills.

At level II, we use the array of microthinking skills to produce

at least ten critical-thinking operations.

At Level I, we use microthinking skills and critical thinking operations in three strategic ways: conceptualizing, decision making, and problem solving.

While thinking is something every human being is capable of doing, we often don't do it well. As stated previously, the problem is due partly to the fact that thinking is a learned process. People expect it of us, but they don't teach us how to think. The other part of the problem is that we don't often think about thinking-- how we are thinking and how we can process the vast amount of information and the unending stream of events that constitute our environment. We tend to be passive receivers, not assertive processors. The process of thinking about thinking is called *metacognition*. As you proceed through these pages and the related activities, you will be exercising metacognition.

Beyer's model needs more explanation and some discussion of where and how a teacher might be addressing these levels of thinking in the classroom.

THINKING SKILLS, OPERATIONS, AND STRATEGIES

LEVEL III MICROTHINKING SKILLS
LEVEL II CRITICAL-THINKING OPERATIONS
LEVEL I THINKING SKILLS

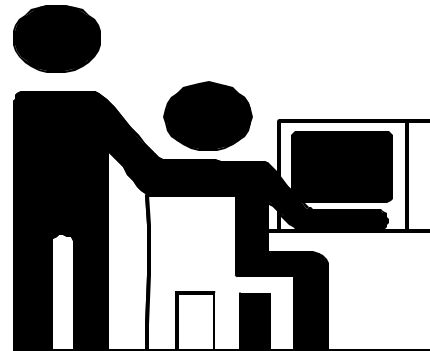
Level III Microthinking Skills

Beyer identifies eight foundational thinking skills.

1. **recall** - to remember facts and bits of information
2. **translation** - to put into simpler or different terms
3. **interpretation** - to explain
4. **extrapolation** - to infer or estimate by extending/projecting known information
5. **application** - to use known information in new settings/situations
6. **analysis** - to separate a concept/idea/entity
7. **synthesis** - to combine elements into a coherent concept/idea/entity
8. **evaluation** - to judge, to determine the goodness/badness, rightness/wrongness, appropriateness/inappropriateness of a situation, concept, idea, etc.

If the reader is familiar with Bloom's taxonomy of cognition, (s)he will recognize the parallels between the Beyer and Bloom structures immediately.

Beyer's eight microthinking skills are Bloom's six levels of cognition expanded. Beyer has simply made three distinct levels (translation, interpretation, and extrapolation) of what Bloom defined as comprehension. Applications for Beyer's microthinking skills may be found in the Resource Section on page 28.



Teachers in classrooms are most likely to call for specific use of these skills in questions they ask in class, in tests, and in certain seatwork or homework assignments.

The skills must be exercised in completing tasks and projects that call for critical-thinking operations (Level II) and thinking strategies (Level III). However, they are not so apparent as they are in questioning because the focus in these tasks and projects is so much broader.

Level II Critical thinking Operations

Beyer identifies 10 critical thinking operations:

1. distinguishing facts from value claims
2. distinguishing relevant from irrelevant information
3. determining factual accuracy of a statement
4. determining credibility of a source of information
5. identifying ambiguous claims or arguments
6. identifying unstated assumptions
7. detecting bias
8. identifying logical fallacies
9. recognizing logical inconsistencies in a line of reasoning
10. determining the strength of an argument or claim

These cognitive activities require us to use at some point or another every microthinking skill. However, you can quickly see that they are procedures involving several steps. For example, distinguishing facts from value claims requires

- a) recall of definitions of fact (something that has been or can be proven) and value claim (something that cannot be proven).
- b) examination of data/information piece by piece, applying these definitions to each piece.
- c) determination/judgment of the extent to which fact or value claim is present throughout the information presented.

A summary of each of the critical- thinking operations is included in the Resource Section on page 31. You will need to study it to understand more about each operation.

It is probably clear to all of us after we think about these operations that they are essential to living in a technological, communication-based world in which we are bombarded with information from all sides all of the time. Teachers in classrooms are most likely to teach or facilitate the use of these operations in activities, projects, and papers requiring critical reading, listening, and sorting of information.

Level I Thinking Strategies

At Level I of his model, Beyer identifies three broad thinking strategies, each characterized by a series of mental steps requiring the use of microthinking skills and critical-thinking operations. Below are the three strategies with the steps pertaining to each:

Conceptualizing

1. identify examples of practice, behavior
2. identify common attributes of the examples
3. classify the attributes
4. interrelate categories of attributes (build a concept)
5. identify additional examples and nonexamples (to see whether the concept fits/works)
6. modify the concept (and attributes) if necessary

Conceptualizing
Decision Making
Problem Solving



Decision making

1. define goals
2. identify alternative approaches
3. analyze each alternative (pros and cons)
4. rank alternatives
5. determine the highest ranked alternative(s) (Why are they highest ranked?)
6. choose the "best" alternative

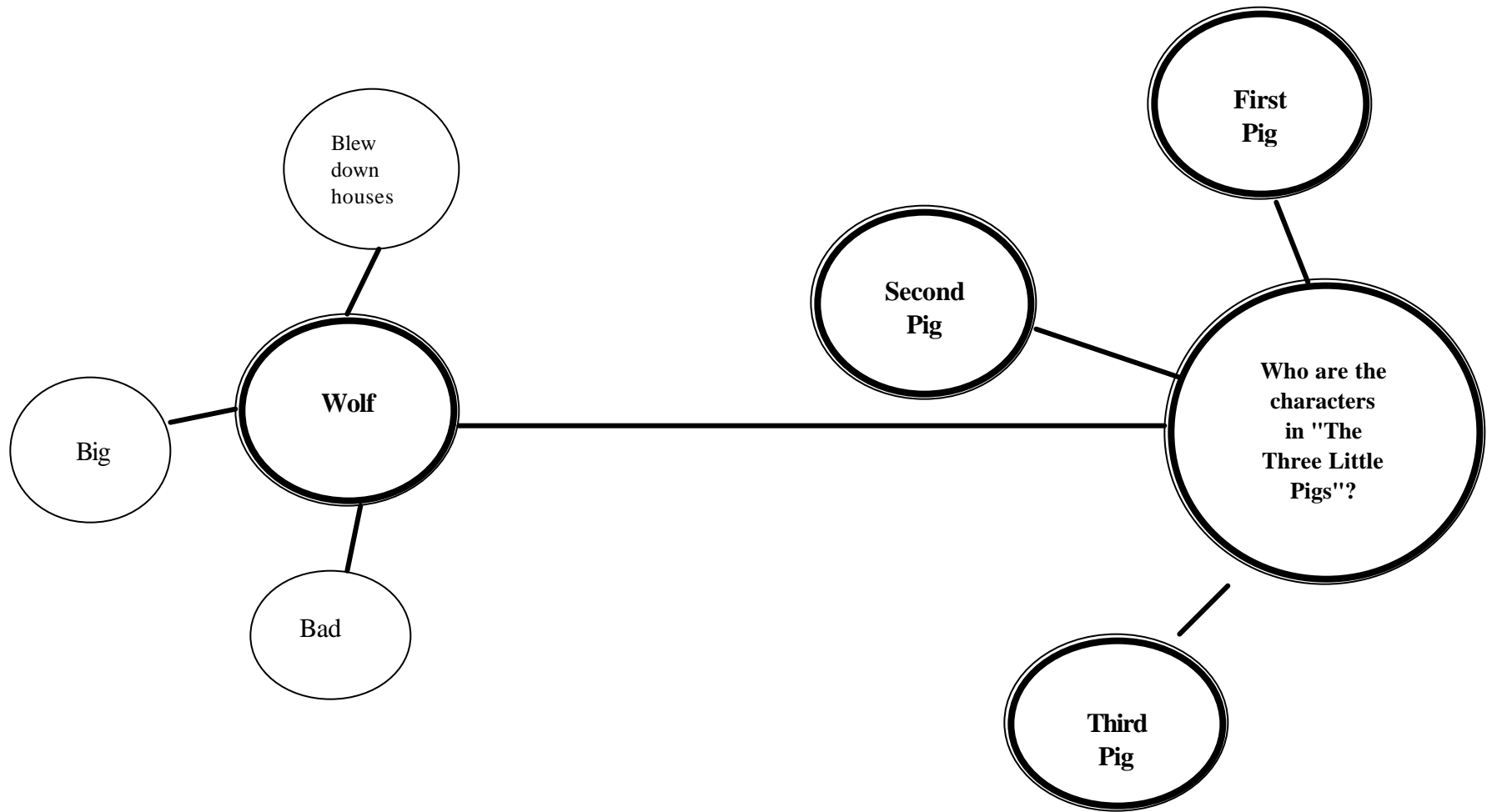
Problem-solving

1. recognize the problem
2. represent/describe the problem
3. devise or choose a plan for solution
4. execute the plan
5. evaluate the results

People often confuse problem solving and decision making. Problem solving requires a problem that must be solved. The process of solving it is essentially application of the scientific method that most of us struggled with during our high school courses in the biological and physical sciences. Decision making doesn't require a problem, but rather a goal to be accomplished. There might be several ways of getting there. We simply have to decide what approach is best for us at this time, given all the data available.

Thinking Skills and

The True Story of the Three Little Pigs



THE TRUE STORY OF THE THREE LITTLE PIGS

ORGANIZER ACTIVITY

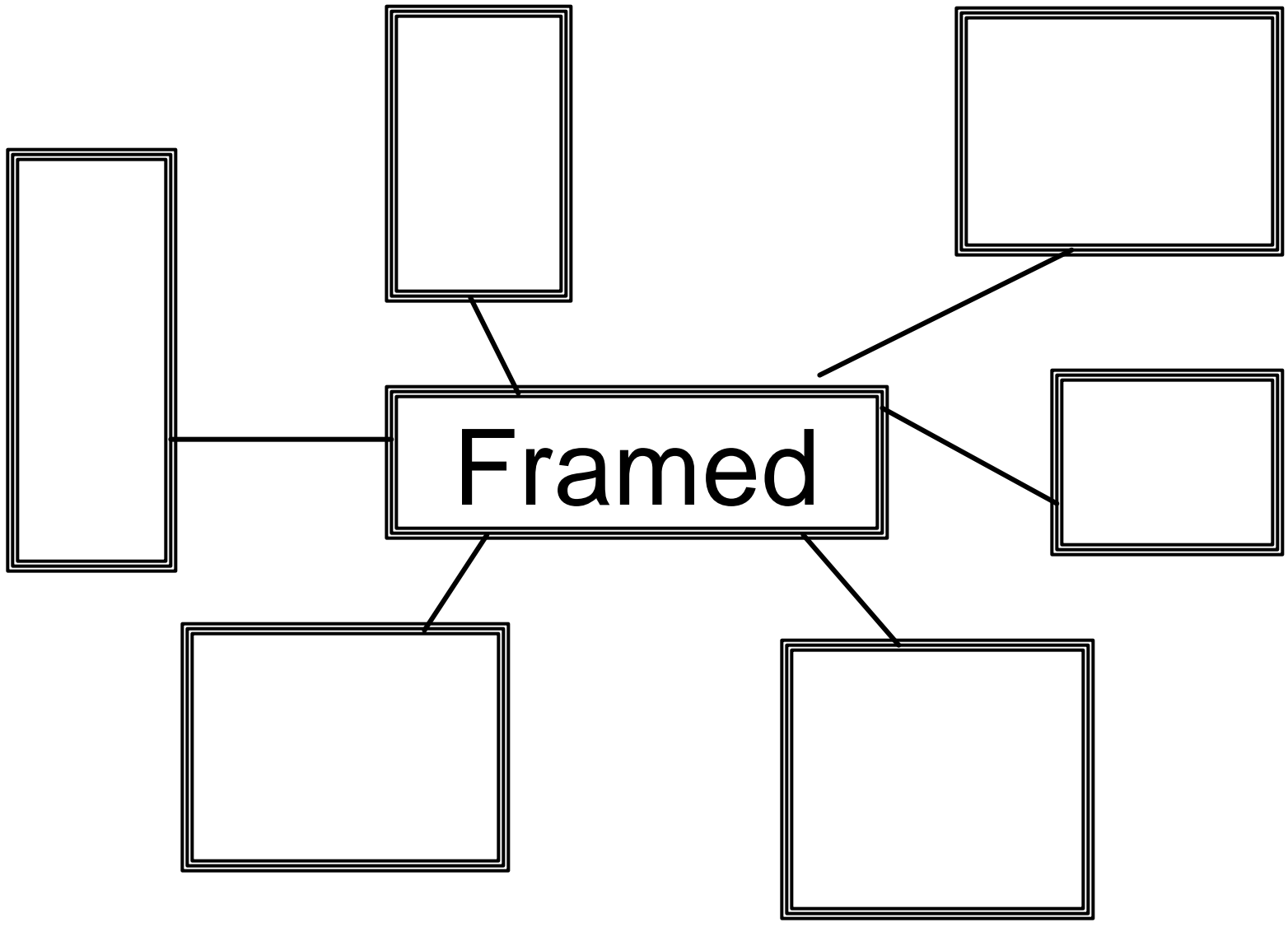
- ∅ Descriptive Pattern --> The wolf believed that he had been framed for the murder of the pigs. As a group, develop associations for the word "framed" and place them on the chart.

- ∅ Generalization Pattern --> Develop a generalization pattern for the statement: "All wolves are bad!"

- ∅ Concept Pattern --> Use the concept pattern to develop the concepts of "guilty" and "innocent."

- ∅ Process/Cause Pattern --> Use information from the story to outline the steps leading to the wolf's arrest.

- ∅ Problem/Solution Pattern --> Use this organizer to determine possible defense strategies Mr. Wolf's defense team could use in court.



Generalization Pattern

ALL WOLVES ARE BAD.

[Empty box for example]

[Empty box for example]

[Empty box for example]

[Empty box for example]

THE TRUE STORY OF THE THREE LITTLE PIGS GROUP ACTIVITY

DEFENSE: You are a criminal defense attorney in the thriving metropolis of Farmland. Your firm has been retained by Mr. Wolf to represent him in his trial for the murder of two members of the influential Pig family and the attempted murder of a third member of the family. Brainstorm possible strategies to use in the defense of Mr. Wolf. What evidence, facts, etc., will you bring to the jury's attention? Prepare a 1-2 minute presentation for your opening remarks to the jury or for use with the media swamping the courthouse. For the defense team, select a spokesperson who will present your ideas to the whole group.

PROSECUTION: You are a member of the district attorney's team of prosecutors in Farmland. Your job is to convict Albert T. Wolf of murder in the matter of the State vs. Albert T. Wolf. Brainstorm possible strategies that could be used in this case to convince a jury that Mr. Wolf is guilty. What evidence, facts, etc., will you bring to the jury? Prepare a 1-2 minute presentation for your opening remarks to the jury or for use with the media swamping the courthouse. For the prosecution team, select a spokesperson who will present your ideas to the whole group.

MEDIA: You work for TV Station DIRT in Farmland U.S.A. You have been assigned to cover the murder and attempted murder of members of Farmland's influential and wealthy Pig family. Mr. Albert T. Wolf has been arrested and charged with these crimes. Prepare a 1-2 minute news story to air on the 6:00 news as a "late-breaking" story. Select a spokesperson for your group to present this story to the group.

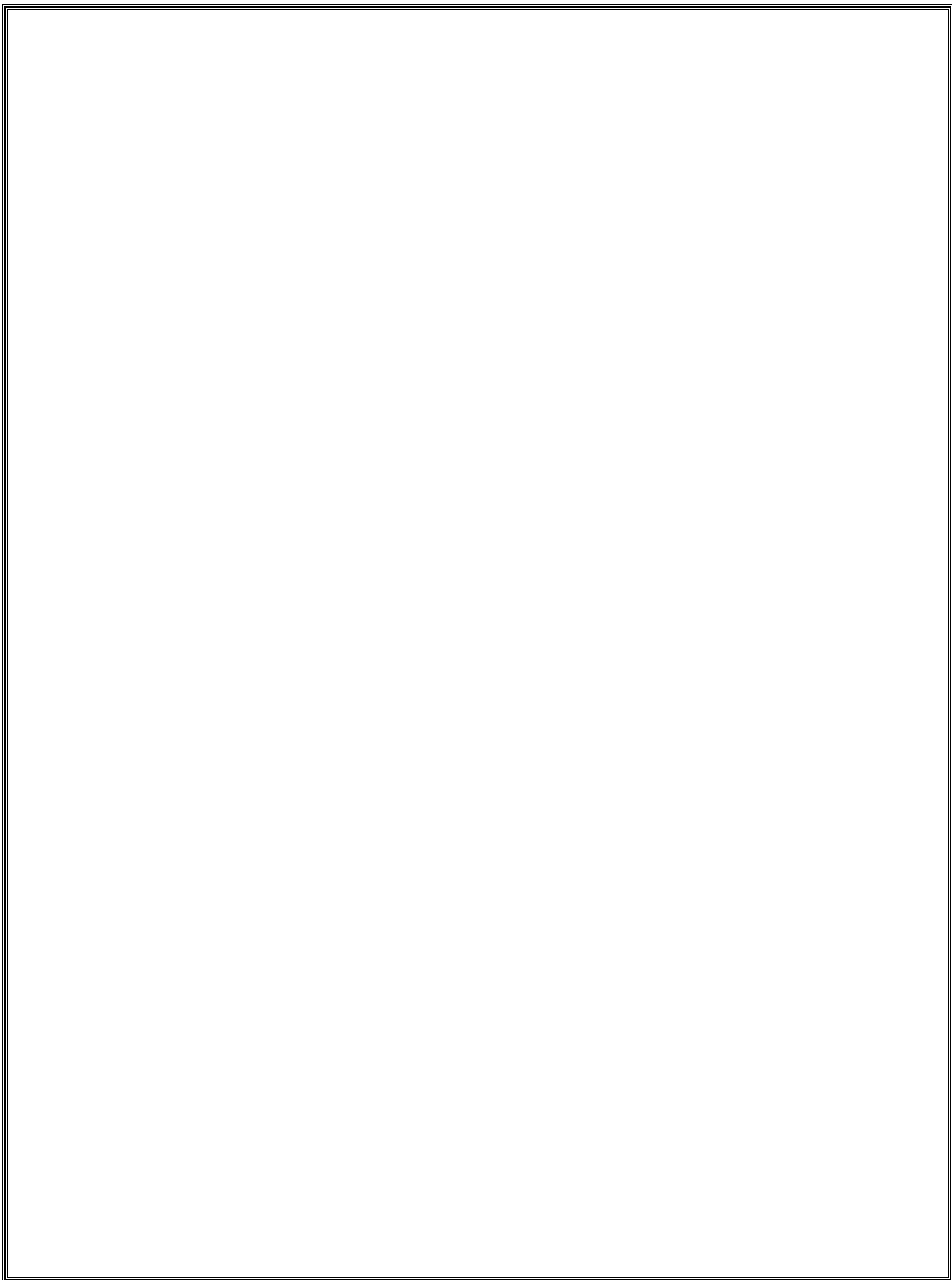
Is Mr. Wolf

Guilty?

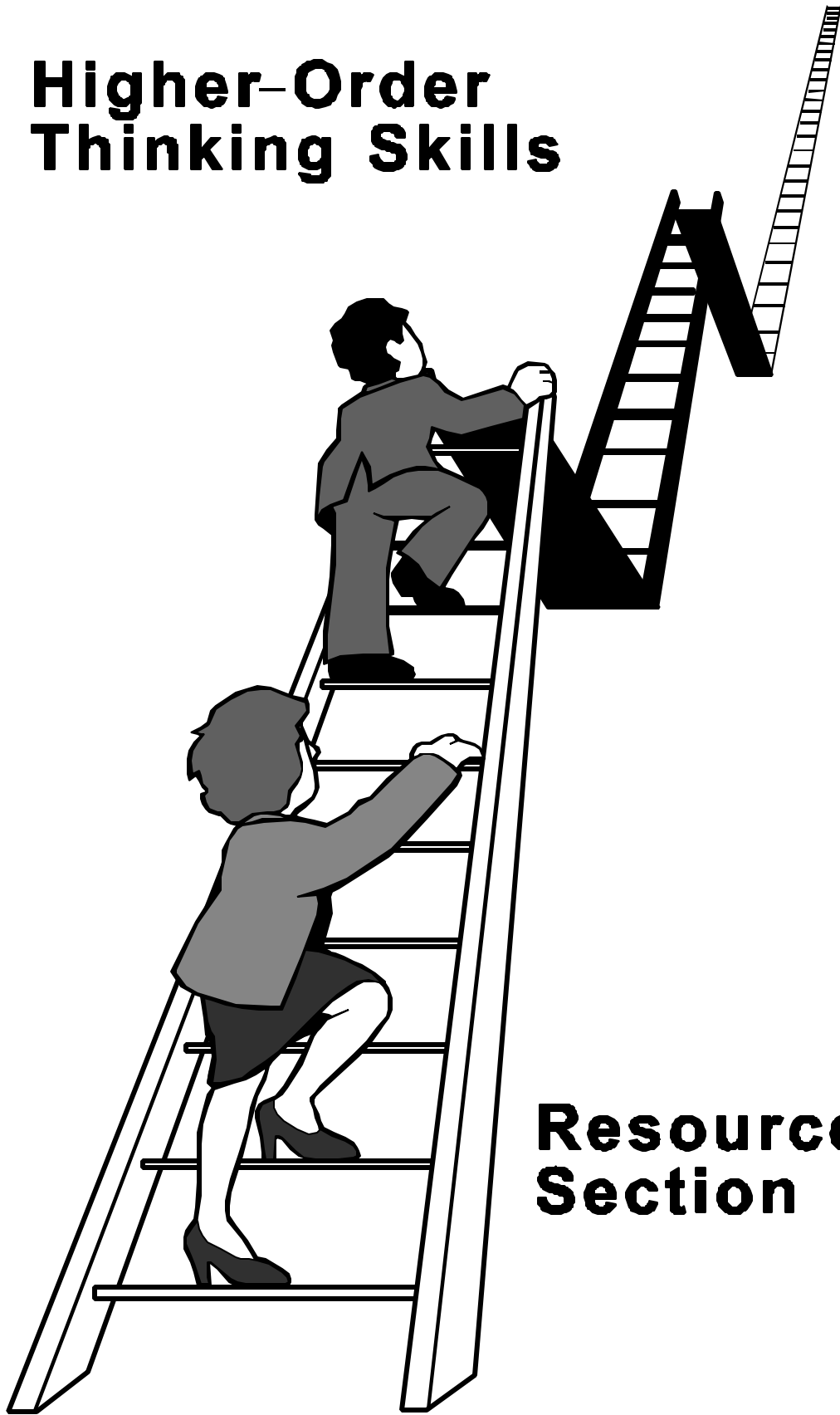
THE TRUE STORY OF THE THREE LITTLE PIGS

The following questions/activities can be used to encourage students to think creatively and critically about the story. Can you add to this list?

1. What are some words that you think of when you hear the word *framed*? How would you define the word?
2. Think of a time when you were accused of something you did not do. Share your experience with a partner. How was the situation resolved? (Option: Students could write about their experience.)
3. What is the relationship of the word *framed* to the concept of *innocent*. What is the relationship of *framed* to the concept of *guilty*?
4. Imagine that you have been framed and are in prison. What does your prison cell look like? How do you feel? Write about your feelings.
5. Brainstorm as many reasons as you can think of as to why we should believe the original story of the AThree Little Pigs.≡
6. Compare the original AThree Little Pigs≡ to the ATrue Story of the Three Little Pigs.≡ Which is more believable? Write a paragraph explaining your rationale.
7. Rewrite the story and change the ending.
8. Write an editorial for the newspaper supporting either the pigs or the wolf.
9. Plan a 1-2 minute news report for Channel KWLF supporting Mr. A. Wolf.
Plan a 1-2 minute news report for Channel KPIG supporting the Pig family.
10. You are the prosecuting attorney who must present the case of the poor little pigs to a jury at Mr. Wolf=s trial. List all the facts of the case. List all the arguments you would present to convict Mr. Wolf of murder.
11. You are the defense attorney representing A. Wolf at his trial for the murder of two pigs and for the attempted murder of the third pig. List all the possible arguments you could present to the jury so they will acquit Mr. Wolf.



Higher-Order Thinking Skills



**Resource
Section**

Some Other Thoughts About Thinking

Critical Versus Creative Thinking

The terms *critical* and *creative thinking* are often used, but sometimes not understood, even by their users. *Critical thinking* is convergent thinking. It assesses the worth and validity of something existent. It involves precise, persistent, objective analysis. It involves the skills, operations, and strategies that have been previously mentioned. *Creative thinking*, on the other hand, is divergent thinking. It generates something new, or at least different. It violates accepted principles. It involves having a different idea that works as well or better than previous ideas. However, it should not be assumed that creative thinking is "off-the-wall" thinking where there are no rules. One writer has suggested that creative thinking is problem solving applied to creative ends: i.e., problem finding, idea generating, planning, synthesizing existing ideas into new ones. In other words, the three thinking strategies identified by Beyer (conceptualizing, decision making, problem solving) require a great deal of creative thinking as well as critical thinking.

Convergent Versus Divergent Thinking

The terms *convergent* and *divergent* were used in describing critical and creative thinking. *Convergent* thinking is cognitive processing of information around a common point, an attempt to bring thoughts from different directions into a union or a common conclusion. *Divergent thinking* starts from a common point and moves outward into a variety of perspectives. When teachers try to get several learners to think convergently, they try to help them develop common understanding, common conclusions about content, whatever it may be. When fostering *divergent thinking*, teachers use the content as a vehicle to prompt diverse or unique thinking among students, rather than a common view.

This module was prepared for the Louisiana Department of Education by Dr. Russell L. French, University of Tennessee, Knoxville.

Since much of what we typically encounter as students requires convergent thinking, you may be having a difficult time understanding the concept of divergent thinking or strategies that you might use to foster that type of thinking in the classroom. Divergent questioning is one method; activities that can result in very different products are another. Following is an example of classroom activity that requires divergent thinking.

- * The teacher has divided the class into cooperative learning groups/teams.
- * The content is social studies. The topic is the colonization of America.
- * The teacher's written directions to the teams are as follows:

Over the next two weeks, you are to study the next four chapters of the text (chapters 3,4,5,6) on the colonization of America. You may also go to whatever sources other than the textbook you wish to use. Then your team must communicate to the rest of us what you have learned from your study.

Remember! Your task is to communicate what you have learned. Your team can do that in many ways. You could prepare an oral or written report, make a videotape, present a play, use art, or dance, or music, or create some combination of these and other means.

Tasks:

1. Decide the role and responsibility of each team member.
2. Determine what resources, in addition to the text, you will use to learn.
3. Determine how you will communicate what you have learned.
4. Determine how the communication will be created.
5. Do what needs to be done!

Inductive Versus Deductive Thinking

Inductive thinking is the process of reasoning from parts to the whole, from examples to generalization. *Deductive thinking* is the reverse process. Reasoning moves from the whole to its parts, from generalizations to underlying concepts to examples.

Open Versus Closed Questions

It is often difficult for teachers and assessors to identify multiple levels of questions in classrooms because there is so much happening. However, there is a simple way to identify questions that elicit higher-order thinking. *Closed questions* are questions that almost always require factual recall, but not higher levels of thinking. *Open questions* are those that do not have predictable answers: e.g., "What kind of president do you think Bobby Kennedy would have been, if he had lived and been elected?" "Why would a Cambodian want to escape that country?" "Why do you think your parents love you?" Open questions almost always require higher-order thinking. Both teachers and assessors can identify questions of two types as a lesson progresses, thereby making it fairly simple to ensure that some higher-order thinking is required of learners.

A Footnote

Thinking is complex, and it is hard work not only to teach but also learn it. Sometimes teachers may be teaching thinking without realizing it. Sometimes, we could be teaching thinking when we are not, if we understood a bit more about it.

The Louisiana Teacher Assistance and Assessment Program for New Teachers incorporates the notions of higher-order thinking skills and processes outlined in this module. In essence, this incorporation provides the new teacher many avenues for fostering thinking in the curriculum. We take the position that thinking skills and processes should not be taught as an add-on subject, but that thinking is best learned and taught in the reading program, the social studies curriculum, in mathematics and science and art. However, good thinking doesn't just happen. There has to be a conscious effort to teach it. New teachers are expected to plan for and attempt to teach thinking in their classrooms. It may take several years to become accomplished in thinking skills instruction, but every teacher should be constantly striving to make it a part of the curriculum.

Beyer's Level III

APPLICATION OF MICROTHINKING SKILLS ACTIVITY SHEET

Work with your partner (assigned by instructor) to complete the following tasks. NOTE: If you are working alone, you need to complete these tasks and share your work with your instructor.

Using the definitions provided for each microthinking skill and the examples presented, write a question and a test item or two questions for each skill. These questions/items should be ones appropriate to the age/grade level(s) and content area(s) you teach.

1. Recall (to remember facts and bits of information)

Examples: "Please name the three parts of a paragraph we have learned."
"When was President John F. Kennedy assassinated?"

Your Questions/Items:

2. Translation (to put into simpler or different terms)

Examples: "Joan, can you give us a definition for >reform= other than the one in our textbook?"

Read the following paragraph carefully; then write a paraphrase of it in your own words.

Your Questions/Items:

3. Interpretation (to explain)

Examples: "Peter, please explain how Br=er Rabbit fooled Br=er Fox when he got Br=er Fox to throw him into the briar patch."

Explain how the process of photosynthesis works. You may use a drawing to aid your explanation, if you wish.

Your Questions/Items:

4. Explanation (to infer or estimate by extending/projecting known information)

Examples: "Rachel, if the short line is 0.4 inches long, estimate how long the longer line is and tell us how you arrived at your answer."

Review the graphs below which clearly show patterns over the past 30 years of a) drug abuse, b) violent crime, and c) suicide among teenagers in the United States. Then describe what you think will happen in each of these areas over the next five (5) years, based on the data from the last thirty (30) years.

Your Questions/Items:

5. Application (to use known information in new settings/situations)

Examples: "Richard, how would you apply the statement we have just discussed, 'Power corrupts and absolute power corrupts absolutely,' to politics in our state or the nation?"

"Class, we have studied the use of light and shadow in a number of photographs. Here is a photograph we haven't seen. Who will tell us how light and shadow have been used here?"

Your Questions/Items:

6. Analysis (to separate a concept/idea/entity into its parts/elements)

Examples: "Teams, your task today is to tear down the automobile engines in front of you: that is, take them completely apart as you might have to do in your own repair shop."

Find and label the topic sentences in each of the following paragraphs.

Your Questions/Items:

7. Synthesis (to combine elements into a coherent concept/idea/entity)

Examples: "Teams, your task today is to assemble the parts in front of you into a working engine.

Write a paragraph of at least four sentences describing "beauty."

Be sure that your paragraph has a clear topic sentence.

Your Questions/Items:

8. Evaluation (to determine the goodness/badness, rightness/wrongness, appropriateness/inappropriateness of a situation, concept, idea, etc.)

Examples: "Sharon, we have discussed the characteristics of a number of United States presidents. Using that information, please tell us what kind of president you believe Bobby Kennedy might have been and why?"

At the front of the room is a painting. Please write your critique (evaluation) of it. You may like it or hate it, but you must use in your critique the principles and ideas we have learned this semester. (If you need to study the painting more closely, you may walk to it for a few minutes. Please do not get in the way of other students who are also trying to study it from their seats).

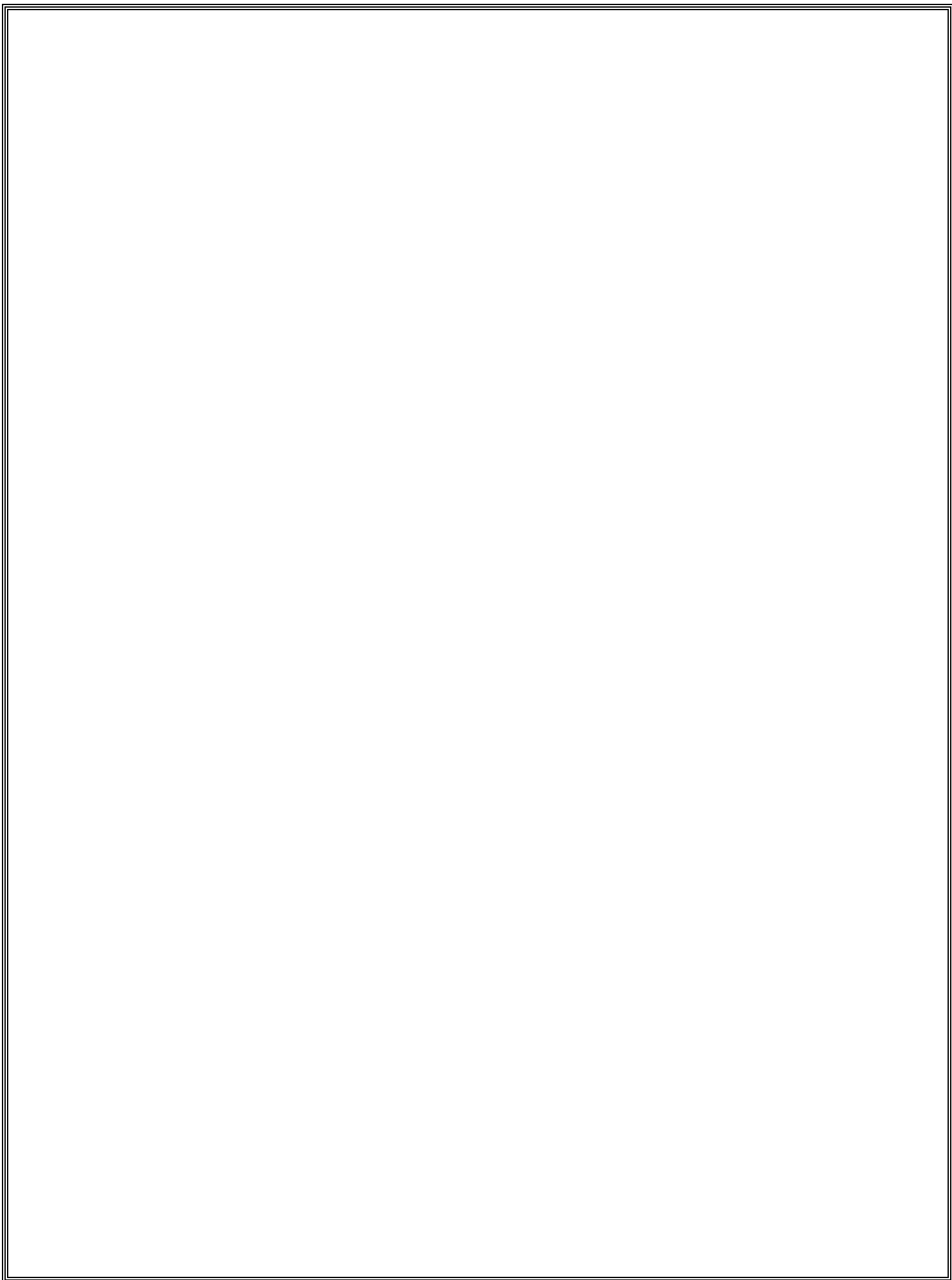
Your Questions/Items:

NOTE: Be prepared to share your questions and test items with the group and to defend their inclusion in the skill areas in which you have placed them.

Beyer's Level II

SUMMARY OF CRITICAL-THINKING OPERATIONS

Most of the information in this summary comes from the work of Dr. Barry Beyer. However, the summary statements have been prepared by Dr. Russell French. Some entries have been extrapolated by Dr. French from Dr. Beyer's work.



WHEN TO USE

- When trying to decide whether or not to accept claim
- When analyzing argument or persuasive argument

OPERATION 3: DETERMINING FACTUAL ACCURACY OF STATEMENT (CLAIM)

1. Identify and define factual claim to be judged.
2. Identify extent to which claim is generally accepted as general knowledge.
OR
3. Consult credible sources to determining extent of their agreement with claim.
AND/OR
4. Conduct research to replicate that which generated the claim.

WHEN TO USE

- Using data to solve problems or make decisions
- When using facts to build generalizations
- When someone is trying to persuade you of something

OPERATION 4: DETERMINING CREDIBILITY OF A SOURCE OF INFORMATION

1. Recall criteria of credibility
 - Author's field of expertise
 - Author's reputation for accuracy
 - Absence of conflict of interest
 - Risk to author if published
 - Appropriateness of methodology
 - Agreement with other sources

2. Identify kinds of evidence that would/should be acceptable.
3. Search information available for evidence.
4. Identify patterns of evidence found.
5. Compare source to other known sources for agreement or disagreement.

WHEN TO USE

- Collecting information for use
- Determining accuracy of information

OPERATION 5: IDENTIFYING AMBIGUOUS CLAIMS OR ARGUMENTS

1. Recall elements necessary for sound argument:
 - Conclusion
 - Reasons
 - Support
2. Search argument to identify these elements.
3. Identify unstated assumptions.
4. Identify how reasons are connected to each other and to the conclusion.

WHEN TO USE

- When trying to determine validity of conclusion
- When someone is trying to convince you of something

OPERATION 6: IDENTIFYING UNSTATED ASSUMPTIONS

DEFINITIONS:

Assume:	To take for granted
Assumption:	That which has to be true if what is given is to be accepted as true
Unstated Assumption:	A supposed truth taken for granted by the author/speaker/communicator that is not made explicit (not stated) to her/his audience. In actuality, the assumption may or may not be true.

EXAMPLE: In the mathematics problem and "right" answer stated below, there is an unstated assumption. However, the assumption is not true. There are more possibilities than the one taken for granted in the supposed "right" answer.

If a person purchased two apples for a total of 10 cents, how much is each apple?

Supposed Right Answer: 5 cents each

Unstated Assumption: The cost of each apple is the same.

This assumption may not be true. A student who offered an answer other than 5 cents each (e.g., 6 cents and 4 cents or 3 cents and 7 cents) would not be wrong, unless the teacher had made equal cost an explicit part of the problem.

WHEN TO LOOK FOR UNSTATED ASSUMPTIONS

- When determining the strength of an argument
- When determining accuracy (truth) of a position taken or of information presented
- When analyzing a persuasive argument
- When determining the author's point of view

OPERATION 7: DETECTING BIAS

1. State the goal to look for evidence of bias.
2. Recall clue: bias-loaded words, loaded questions, overgeneralization, one-sidedness, rhetorical questions, etc.
3. Go through data line by line or piece by piece seeking evidence of bias clues.
4. Identify patterns in clues.
5. State the bias.

WHEN TO SEARCH

- When the material seeks to persuade
- When judging accuracy of statement/source
- When identifying author's point of view

OPERATION 8: IDENTIFYING LOGICAL FALLACIES

1. State the kind of fallacies for which you are looking:
 - Bandwagon effect
 - Circular reasoning
 - Guilt by association
 - Appeal to compassion
 - Name calling
2. Identify clues to this type of fallacy.
3. Search argument for clues.
4. Determine grounds that would be more logical.
5. State your finding and support it.

WHEN TO USE

- When analyzing the argument, persuasion
- When producing argument
- When argument appeals to authority

OPERATION 9: RECOGNIZING LOGICAL CONSISTENCY OR INCONSISTENCY

In a logically consistent argument or presentation of information, each idea or concept follows from the ideas and concepts preceding it. One can follow the argument easily and understand it because each new thought builds on what has already been presented.

EXAMPLE: Read the four sentences below. Then number the sentences in their most logical order.

- _____ A. Computer artists think of the computer screen as a piece of graph paper.
- _____ B. By coloring in each pixel with the right color, computer artists can make almost any picture appear on the screen.
- _____ C. These squares, called pixels, are the building blocks for computer pictures.
- _____ D. When they look at the screen, they imagine that they are looking at a full page of small, equal-sized squares.

Obviously, the logical order of the information presented is A, D, C, B. Any other order of presentation doesn't "make sense." To understand concept of computer artistry, the reader must have the information presented in a logically consistent way.

WHEN TO LOOK FOR LOGICAL CONSISTENCY

- In receiving any written, visual, or oral presentation of information, one should always ask, "Does this make sense?" "Is it logical?"

OPERATION 10: DETERMINING THE STRENGTH OF AN ARGUMENT OR CLAIM

1. Clarify the conclusion being proved (and define vague terms).
2. Identify reasons, stated and unstated, given to support the conclusion:
 - Facts
 - Rules
 - Generalizations
3. Distinguish relevant from irrelevant (facts from value judgments and bias).
4. Evaluate reasons for
 - content: accuracy, sufficiency, significance
 - structure: logic, absence of fallacies, consistency.
5. Make a judgment about the strength.

Beyer's Level I Thinking Strategies

GROUP ACTIVITIES

On the following pages are two activities: The "Campbell Soup Game" and "Tomato Plants." The "Campbell Soup Game" is a problem-solving activity and "Tomato Plants" is a decision-making activity. Students may work with partners or small groups to solve the problems. Results and plans may then be shared with the group.

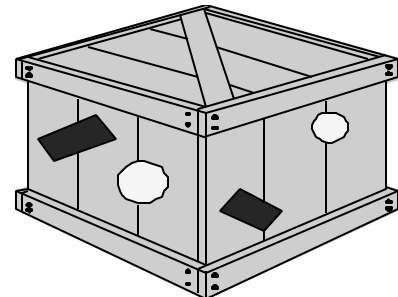
CAMPBELL SOUP GAME

The task of your team is to solve the following problem:

Your group is a team of explorers sent from the planet Juno to the planet Earth in the year 2300 A.D. Your mission is twofold. You are to find out:

1. Whether or not Earth can support life.
2. Whether or not life exists or ever has existed on the planet.
3. If you feel that life has existed, how advanced it might have been.

When you arrive on Earth, you find everything desolate. There are no cities, farms, or visible forms of life, either animal or plant. In fact, the only thing you find in your explorations is a box buried just beneath the land's surface. Inside the box are five cans of Campbell's soup.



Based on your discovery, what would you report back to your superiors relative to the goals of your mission, and what evidence would you use to support the specifics of your report?

You must report as fully and specifically as possible, and your report must represent the thinking of your entire team. Use the attached worksheet.

CAMPBELL SOUP GAME: WORKSHEET

1. What is/are the problem(s) to be solved?
2. Describe the conditions which create the problem(s).
3. How will you solve the problem, given the information and artifacts available to you?
4. Following your plan for solution (Item 3), what would you be likely to find that would allow you to develop your report?
5. Prepare your report. (What are your conclusions regarding Earth's capacity to support life and current or past presence of life on the planet?) You may use the back of this sheet or other paper.

CAMPBELL SOUP GAME: WORKSHEET

1. What is/are the problem(s) to be solved?

***Determine whether Earth can support life.
Determine whether anyone has ever existed there.***

2. Describe the conditions which create the problem(s).

Explorers find Earth desolate, except for the box containing cans of soup.

3. How will you solve the problem, given the information and artifacts available to you?

***Read the labels on the soup cans.
Study the findings (observations).***

4. Following your plan for solution (Item 3), what would you be likely to find that would allow you to develop your report?

***Can labels contain information about contents, nutritional value, language, numerical system, economic systems, etc.
There are a box, cans, labels (manufacturing of several kinds), printing process (labels).***

5. Prepare your report. (What are your conclusions regarding Earth's capacity to support life and current or past presence of life on the planet?) You may use the back of this sheet or other paper.

***Life has existed on Earth.
Life form(s) were highly developed as evidenced by the findings - - had a language system, an advanced numerical system, variety of manufacturing processes, advanced understanding/research in sciences, economic system.
We don't know from evidence presented (found) whether life can now be supported. More information is needed.***

TOMATO PLANTS



SETTING/SITUATION:

The setting is a third grade classroom. It is May 15. In early March, each youngster planted a tomato seed as part of a science project. Most seeds survived, and there are now eighteen healthy tomato plants growing in the room. Since school will soon be ending, a decision must be made about what to do with the tomato plants. You are the teacher. Obviously, you could decide what to do with the plants. But, you could make this an opportunity for the class to exercise the decision-making thinking strategy.



Review the steps in decision making; then develop with your partner a plan for a class decision-making activity. Use the attached worksheet for planning.

TOMATO PLANTS: WORKSHEET

1. What is the goal of the decision-making?
2. How will you get students to identify alternative approaches to achieving the goal?
3. How will you get students to analyze (provide the pros and cons of) each possible approach?
4. How will you get students to rank the approaches that have been identified and discussed?
5. How will you determine which alternative is ranked highest?
6. Will the highest ranked alternative be considered the "best" alternative? If not, how will you determine from the information now available the "best" alternative?

TOMATO PLANTS: WORKSHEET

1. What is the goal of the decision-making?

Determine what to do with tomato plants.

2. How will you get students to identify alternative approaches to achieving the goal?

Let them brainstorm - - offer suggestions. (Accept their ideas without evaluation/judgment initially.)

3. How will you get students to analyze (provide the pros and cons of) each possible approach?

Go through the list of suggestions with them; get them to list pros and cons of each suggestion.

4. How will you get students to rank the approaches that have been identified and discussed?

Have them show hands in favor of each suggestion or have each student rank suggestions after the discussion. (This is the better approach.)

5. How will you determine which alternative is ranked highest?

Let them compute rankings and see which suggestion has the highest ratings.

6. Will the highest ranked alternative be considered the "best" alternative? If not, how will you determine from the information now available the "best" alternative?

Let students discuss once more after seeing the rankings. Work for consensus (common agreement).

Graphic Organizers

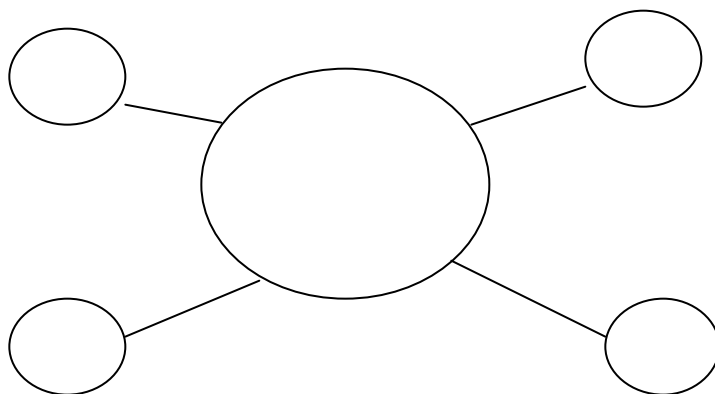
Beyer has helped us organize our thinking about thinking. We have explored a number of ideas that teachers might do in classrooms to teach thinking and what assessors might look for when seeking evidence of thinking skills instruction. Graphic organizers are another tool worth mentioning.

A graphic organizer is a visual aid that graphically presents the major elements of a concept or topic. The structured organizer can be used by the teacher in the presentation of information or by the student as a means of "laying out" the concept being presented.

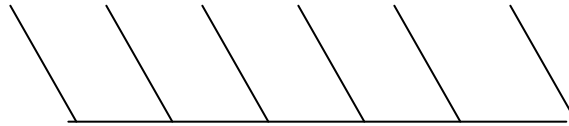
There are three potential benefits of structured organizers:

- 1) They keep the student actively involved in the presentation and better able to follow the flow of instruction.
- 2) They can be used to pin information onto previously presented concepts.
- 3) The presentation can be given in a step-by-step sequence which may help with student comprehension of information.

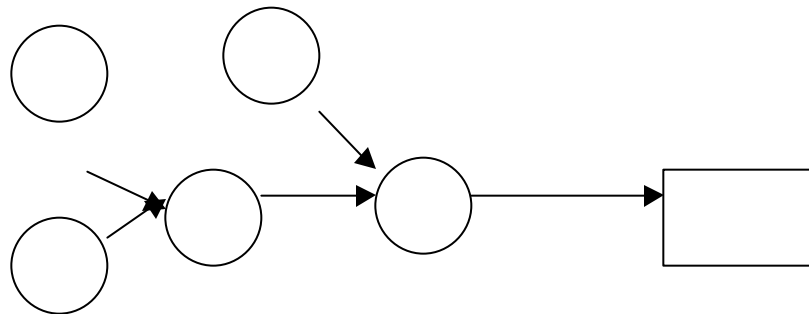
- a. **Descriptive patterns** Organize facts or characteristics about specific persons, places, things, and events. The facts or characteristics need be in no particular order. For example, information in a film about the Empire State Building - when it was built, its height, how many rooms it has, and so on - might be organized as a simple descriptive pattern. This pattern can be represented graphically in the following way:



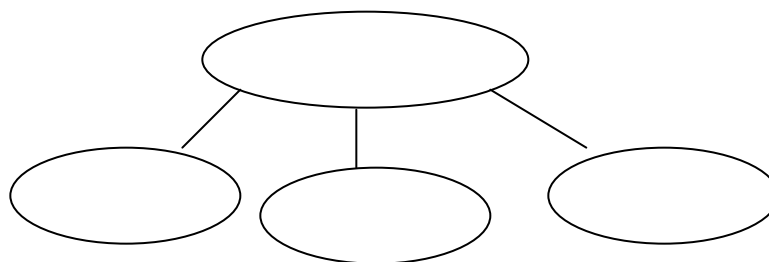
- b. **Sequence patterns** organize events in a specific chronological order. For example, a chapter in a book relating the events that occurred between Kennedy's assassination on November 22, 1963, and his burial on November 25, 1963, might be organized as a sequence pattern. This pattern can be represented graphically in the following way:



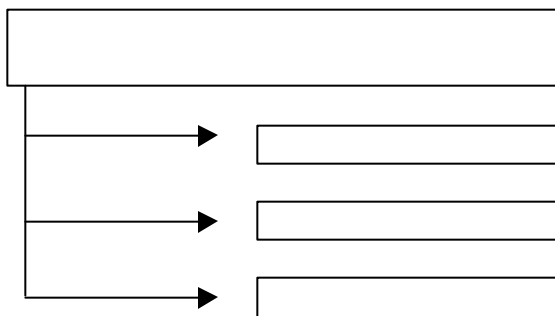
- c. **Process/cause patterns** organize information into a causal network leading to a specific outcome or into a sequence of steps leading to a specific product. For example, information about the events leading to the Civil War might be organized as a process/cause pattern. This pattern can be represented graphically in the following way:



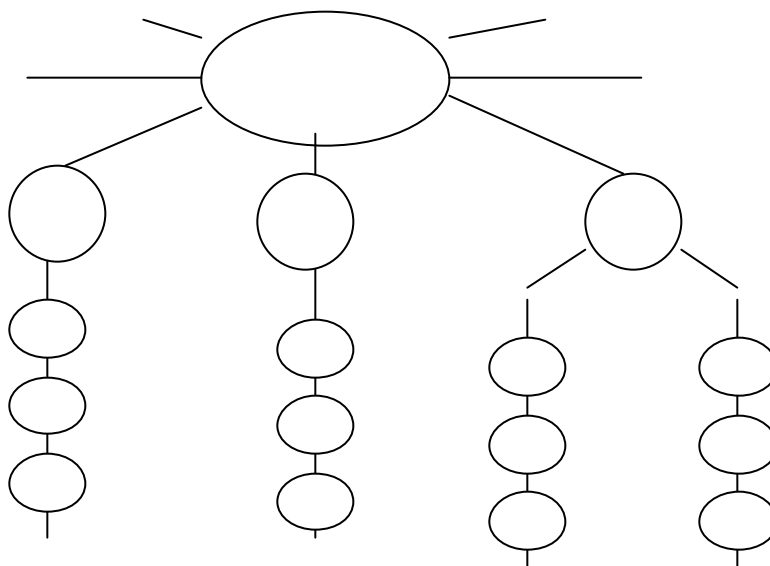
- d. **Problems/solution patterns** organize information into an identified problem and its possible solutions. For example, information about various types of diction errors that can occur in an essay and the ways of correcting these errors might be organized as a problem/solution pattern. This pattern can be represented graphically in the following way:



- e. **Generalization patterns** organize information into a generalization with supporting examples. For example, the statement "U.S. presidents often come from families that have great wealth or influence" is a generalization. We can provide examples for it. This pattern can be represented graphically in the following way:



- f. **Concept patterns** are perhaps the most general of all patterns. Like descriptive patterns, they deal with persons, places, things, and events--but not specific persons, places, things, and events. Rather, they represent an entire class or category and they usually illustrate specific examples and defining characteristics of the concept. For instance, information about President Bush would probably be organized as a simple descriptive pattern--specific facts about a specific president--whereas information about the general concept of "presidents" might be organized as a concept pattern. The concept of "presidents" has defining characteristics and specific examples. Concept patterns can be represented graphically in the following way:



CRITICAL-THINKING ACTIVITIES FOR THE CONTENT CLASSROOM

Suitable for elementary and secondary levels

1. **Graffiti Needs Assessment.** (Goza, 1993). For the first class meeting, write 10 partial sentence beginnings on the top of newsprint and post around the room. Include items such as the following:
 - # In this class, I worry about. . .
 - # I want my teacher to. . .
 - # I like to learn about. . .
 - # I learn the most when. . .
 - # I want to learn about. . .

Ask each student to walk around the room and respond to the sentences on the newsprint. Then discuss student responses and answer their comments and concerns. Discuss their expectations about the course and your performance and your expectations about the course and their performance.

2. **Periodical Dissection.** Divide your class into groups. Provide groups with copies of newspaper or magazine articles (or book club order forms) that pertain to the topic you are teaching. Prepare a set of questions that they can answer after they have read the information from the periodical. After groups have answered the questions, discuss periodical articles and questions/answers with the entire class.
3. **Discussion Notecards.** (Conderman, G. J., 1993). Ask students to prepare a 5 x 7 index card for each major reading assignment. Ask them to record at least five complete thoughts, ideas, reflections from or opinions about the reading that they would be willing to share with the class. In groups of two or more, ask students to share notecards and summarize questions, concerns, and opinions. Assigning 3-5 points for each card helps motivate students to do the assignment and shows that you value it.
4. **Twenty Questions.** Ask each member of a group to identify and write on a piece of paper a concept, process, or topic of major importance in the story or chapter currently under study and create a yes/no question about it. Collect topics, so as to avoid duplication of topics among group members.
5. **P-N-I.** After a debate, discussion, or reading, divide students into groups and have them list what they found to be POSITIVE, NEGATIVE, and INTERESTING about the information under consideration.

6. **Press Conferences.** (Keller, 1993). Announce a press conference one or two class periods prior to holding it. Identify the speaker and topic of the conference. On the day of the conference, give a 10-minute lecture to set the stage of the conference. Remind students of the reasons for the conference and provide any additional background information they might need. You may serve as the person to be interviewed. After the conference, ask students to work in small groups to identify main ideas from the conference and create headlines or news articles that highlight those ideas. Students then compare and critique articles with their peers.
7. **Case Studies.** Furnish students with real or created situations and ask them to identify the facts, define the problem, generate and evaluate possible solutions, and create a workable plan of action. Be sure to provide well written directions as well as complete information about the case in your initial assignment.
8. **Action Mazes.** (Broadwell, 1989). Provide students with a problem with three possible solutions: one is right and is time-efficient in its solution; one is okay but is not time-efficient in its solution; and one sounds right but is wrong and is not time-efficient in identifying inaccuracies.
9. **Classroom Humor.** Collect editorial cartoons, comic strips, and so forth, that show concepts taught in your courses. Provide copies for groups and ask them to identify the situation in the cartoon and the course information which pertains to it. Have them discuss how knowing more about this information contributes to their understanding and appreciation of the cartoon. One caution: Copyright laws forbid the duplication of such materials--be sure to write for permission for classroom use.
10. **What's Wrong with This Picture?** Create paragraphs or essays which contain both correct and incorrect information about a major topic. Divide the class into groups and have the group rewrite the text, correcting faulty information. Then have them highlight any corrections. One paper per group is graded--highlighted information facilitates this grading.
11. **Crib Sheets.** Allow students to record any facts, definitions, and formulas on a 5 x 7 index card. Check cards to determine whether students are recognizing the most important information to learn. Allow students to use these legal crib sheets on exams. This procedure allows you to move from testing recall of factual information to analysis, synthesis, and evaluation of information.
12. **Charting.** In situations in which information can be compared and/or contrasted, create a chart format and have students fill in the information. As the semester progresses, they can create the chart format themselves. Showing the student how a sample test question could be answered using the chart validates the process for students.

13. **Group Projects.** Assign groups research papers, presentations, or other projects they must work together to complete.
14. **Roundtable.** Divide the class into groups. Choose a topic for investigation. On one piece of paper, have students write all they know about a topic, stating their ideas aloud as they write. After one student has finished, the paper is passed to the next person who adds his/her information. This process continues until one topic or issue has been completely exhausted.
15. **Jig-Saw Learning.** (Parker, 1990). Based on course reading assignments, this activity provides students with opportunities to become content experts and to share information in short presentations. To create content experts, divide students by the number of topics on which you want expert information. For example, if you have 30 students in class and you wish to focus on 5 decades of history, each group would consist of 6 students, with each group focusing on 1 decade of history. The groups pool their understanding to form an expert understanding of that information. They analyze information, look for significance and relevance, and create a synthesis of what they know. When all groups are ready, redivide the groups so that each new group has one member that is expert in each decade (in this case, 6 groups of 5 each). Each group provides a panel presentation based on the information. Class notes consist of panelists' information and comments.
16. **Group Testing.** Allow students to take an exam or write a paper in groups. This procedure not only cuts down on grading time but also encourages active exchange of information.
17. **Question, Question.** Assign groups of students a section of the story or chapter to read and summarize. Ask them to create one or two questions about the section. Use these as the basis of class discussion.

Suitable for Secondary Students

1. **Debates.** (Malcolmson & Myers, 1993). Ask students to write a research essay on a chosen topic, listing reasonable arguments and detailed information to support the point of view they wish to take. Use a three-stage formation in which each debater is first allowed a certain amount of time to make a set speech. In the second stage, each participant rebuts his opponent, and in the third, free discussion takes place. End by having the class take a vote so that debaters remember their goals are to convince open-minded people that their positions are more reasonable than those of their opponents. Debates scheduled near the middle or end of the term (rather than at the beginning) and with better students going first yield better results.
2. **Cross Debate.** Have students follow instructions from previous activity for researching debate topic. After students have researched their topics, have them debate alternative points of view.
3. **Twenty Questions Revisited.** (Fry, 1993). Divide your class into groups. Provide students with 20 fairly demanding essay questions in advance of an exam. Tell them that on the day of the exam they will be asked 2 out of 3 or 3 out of 4 of the 20. These will count for 70 percent of the points on the test. An objective section will count for the remaining 30 percent. Allow class time for group discussions of the 20 questions; suggest that they might want to meet outside class to study together.
4. **Note Swapping.** Provide opportunities for students to exchange and critique the notes of peers after major topics in lectures or after large reading assignments.
5. **Return to Sender.** Each member of a group writes a review question on a card. Each group member passes the card to the group member on his/her left. This member answers the question on the back of the card and sends it to the next member on the left. This member reads the question and answer and comments about the information given in answer to it. He/she then passes the card on. Once every group member has read and commented on every question, the cards return to sender. The sender reads his/her question and the comments on the back aloud. The group reaches consensus on the answer to each question. These questions are then collected and passed to another group. This group reads each question and attempts to answer it without referring to information written on the back of the card. After reaching consensus on the answer, they check their answer with the back of the card. This process continues until every question has been reviewed. Cards are then collected and sent to another group, where the process begins again.

6. **The True-False Twist.** (Dennick-Brecht, 1992). Provide students with 10-15 true-false items that involve major concepts as well as defections, statistics, and dates. Questions should range in difficulty from easily answered by all students to challenging for all students. Tell them grades won't count, so they need to relax and do their best. After about 5 minutes or so, ask each student to find a partner and discuss and reach consensus on answers to at least 8 questions. This activity takes 5-10 minutes. Next, ask pairs to join with another pair to discuss and reach consensus on at least 7 questions. This process will take another 10 minutes. Finally, read each question aloud and get volunteer answers. Encourage discussion and debate. Correct misconceptions only after all class members have had a chance to do so.

7. **Action Flow Plan.** (Haramin, 1994). This plan initiates learning by asking students to write a response to a thought-provoking question based on the reading assignment for that class (Stage 1). As soon as two or three students have finished, ask the rest of the students to finish the thoughts on which they are currently working. Using probing questions (e.g., Would someone like to share a response? Do you agree with the first response. . .if not, why not? Can you clarify that response? What else could be added? In what situation might that apply?), facilitate a discussion of the information without providing additional information (Stage 2). Ask students to form pairs and ask each pair to discuss the information and construct notes which provide an answer to the question. This process actually becomes the essence of the students' notes for the topic. Give students only a few minutes to complete this activity (Stage 3). Finally, to close the activities, add a few comments and thoughts about aspects of the topic which have not yet been addressed and which serve to amplify, apply, analyze, synthesize, or evaluate the information that has already been discussed (Stage 4).

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- 8 Longman, D. L. and Atkinson, R. H., 1995

Enhancing Thinking Checklist

1. Am I sure of what I want students to know (essential associations, concepts, and principles)?
2. Am I linking new learning to what students already know?
3. Am I providing rich and challenging learning experiences?
4. Am I structuring activities that help students see relationships, make connections, and build knowledge?
5. Am I giving too much information?
6. Am I furnishing information at appropriate times?
7. Am I using aids and materials to enhance thinking?
8. Am I encouraging students to present their ideas and experiences?
9. Am I encouraging students to elaborate upon their ideas and the ideas of others?
10. Am I providing students time to question and reflect?
11. Am I helping students to produce new ideas?
12. Am I helping students to analyze and evaluate their ideas and the ideas of others?
13. Am I helping students to apply their ideas in other contexts?
14. Am I using group activities that allow students to interact with others?
15. Do I know when students are engaged in thinking?

A Taxonomy of Socratic Questioning

It is helpful to recognize, in light of the universal features in the logic of human thought, that there are identifiable categories of questions for the adept Socratic questioner to dip into: questions of clarification, questions that probe assumptions, questions that probe reasons and evidence, questions about viewpoints or perspectives, questions that probe implications and consequences, and questions about the question. Here are some examples of generic questions in each of these categories:

QUESTIONS OF CLARIFICATION

- # What do you mean by ____?
- # What is your main point?
- # How does ____ relate to ____?
- # Could you put that another way?
- # Is your basic point ____ or ____?
- # What do you think is the main issue here?
- # Let me see whether I understand you; do you mean ____ or ____?
- # How does this ____?____ relate to our discussion (problem, issue)?
- # What do you think John meant by his remark? What did you take John to mean?
- # Jane, would you summarize in your own words what Richard has said? Richard, is that what you meant?
- # Could you give me an example?
- # Would this be an example?
- # Could you explain this further?
- # Would you say more about that?
- # Why do you say that?

QUESTIONS THAT PROBE ASSUMPTIONS

- # What are you assuming?
- # What could we assume instead?
- # You seem to be assuming _____. Do I understand you correctly?
- # All of your reasoning depends on the idea that _____. Why have you based your reasoning on _____ rather than _____?
- # You seem to be assuming _____. How would you justify taking this assumption for granted?
- # Is it always the case? Why do you think the assumption holds here?
- # Why would someone make this assumption?
- # What is Karen assuming?

QUESTIONS THAT PROBE REASONS AND EVIDENCE

- # What would be an example?
- # How do you know?
- # Why do you think that is true?
- # Do you have any evidence for that?
- # What difference does that make?
- # What are your reasons for saying that?
- # Could you explain your reasons to us? ! But is that good evidence to believe that ? ?
- # Is there reason to doubt that evidence?
- # Who is in a position to know whether that ? is so?
- # What would you say to someone who said _____?
- # Can someone else give evidence to support that response?
- # By what reasoning did you come to that conclusion?
- # How could we find out whether that is true?

QUESTIONS ABOUT VIEWPOINTS OR PERSPECTIVES

- # You seem to be approaching this issue from _____ perspective. Why have you chosen this rather than that perspective?
- # How would other groups/types of people respond? Why? What would influence them?
- # How could you answer the objection that _____ would make?
- # What might someone who believed _____ think?
- # Can/did anyone see this another way?
- # What would someone who disagrees say?
- # What is an alternative?
- # How are Ken's and Roxanne's ideas alike? Different?

QUESTIONS THAT PROBE IMPLICATIONS AND CONSEQUENCES

- # What are you implying by that ___?_? # When you say _____, you are implying?
- # But if that happened, what else would happen as a result? Why?
- # What effect would that have?
- # Would that necessarily happen or only probably happen?
- # What is an alternative?

If *this* and *this* are the case, then what else must also be true?

If we say that *this* is unethical; how about that?

QUESTIONS ABOUT THE QUESTION

How can we find out?

Is this the same issue as ____?

What does this question assume?

How would ____ put the issue?

Would ____ put the question differently?
important?

Why is this question

How could someone settle this question?
question down at all?

Can we break this

Is the question clear? Do we understand it? Why?
Is this question easy or hard to answer?

Does this question ask us to evaluate something?

Do we all agree that this is the question?

To answer this question, what questions would we have to answer first?

I'm not sure I understand how you are interpreting the main question at issue.

To participate effectively in Socratic questioning, one must:

listen carefully to what others say

take what they say seriously

look for reasons and evidence

recognize and reflect upon assumptions

discover implications and consequences

seek examples, analogies, and objections

seek to distinguish what one *knows* from what one *believes*

seek to enter empathetically into the perspectives or points of view of others

be on the alert for inconsistencies, vagueness, and other possible problems in

look beneath the surface of things

maintain a healthy sense of skepticism

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