

MODELS

Model n 1: a simplified description of a complex entity or process.

Source: *WordNet* ® 1.6, © 1997 Princeton University

Featured in this section are exemplary models for complex thinking, reasoning and learning processes. Student activities need to be intellectually demanding, challenging them by requiring a higher level of response or by open-ended questions that stimulate inquiry, industrious exploration, and purposeful discovery.

Teachers need to encourage students to think about subjects in more abstract and complex ways, to stimulate and encourage higher level thinking skills and to promote self-directed learning.

Significant contributors whose models are briefly mentioned within this section are Richard Paul, Linda Elder, Benjamin Bloom, Hilda Taba, E. P. Torrance and Sidney Parnes.

~Jackie Buisman

PAUL AND ELDER'S ELEMENTS OF REASONING

The Elements of Reasoning is found on the internet by Gilbert Public Schools - Gilbert, Arizona <http://www.gilbert.k12.az.us/index.html>.

The Elements of Reasoning

Teachers sometimes struggle with crafting good critical thinking questions that get at the heart of the problem. Richard Paul and Linda Elder from the Foundation of Critical Thinking developed the Elements of Reasoning to address the underlying elements of logical and critical thinking. Although you may want to add some of your own, the eight elements they identified are excellent. Good critical thinking questions are the fall out of considering the Elements. Below is a brief outline of Paul and Elder's Elements of Reasoning.

1. What are the fundamental goals and objectives of the lesson?
2. What is the question or problem at issue you are trying to answer or solve?
3. What information or data do you need to answer the problem or issue?
4. What is the information or data telling you? What inferences and interpretations can you legitimately make?
5. What are the implications or consequences of your thinking (what follows from thinking this rather than that)?
6. What are the key ideas or concepts that will help you answer the question or solve the problem?
7. What are your assumptions (should you be taking this or that for granted)?
8. Are you adopting the most reasonable point of view

with respect to the issue?

Annotated from Richard Paul and Linda Elder's "Critical Thinking: Teaching Students To Seek the Logic of Things"

Universal Intellectual Standards

Students should be taught what intellectual standards for which they are held accountable. Richard Paul and Linda Elder of the Foundation for Critical Thinking have identified eight standards students should learn. You may want to add some of your own, but be careful that your final list of standards is short enough for students to grapple with -- this is another venue where "less can be more."

Below are Paul and Elder's list of Universal Intellectual Standards.

Clarity-Could you elaborate further?
Could you illustrate what you mean?
Could you give me an example?

Accuracy-How could we check on that?
How could we find out if that is true?
How could we verify or test that?

Precision-Could you be more specific?
Could you give me more details?
Could you be more exact?

Relevance-How does that relate to the problem?
How does that bear on the question?
How does that help us with the issue?

Depth-What factors make this a difficult problem?
What are some of the complexities of this question?
What are some of the difficulties we need to deal with?

Breadth-Do we need to look at this from another perspective?

Do we need to consider another point of view?
Do we need to look at this in other ways?

Logic-Does all this make sense together?
Does your first paragraph fit in with your last?
Does what you say follow from the evidence?

Significance-Is this the most important problem to consider?

Is this the central idea to focus on?
Which of these facts are the most important?

Incorporating Bloom's Taxonomy

The *Teaching for Thinking* technique depends on the teacher thinking critically about his or her lesson and posing questions that move students beyond basic fact recall. An indication that a lesson has too many recall questions and not enough higher level questions is the reactions of your students. Having to answer 60-plus recall questions in a lesson is not very interesting, challenging or exciting. If your students are bored, examine the level of questions you ask. Be sure to move into the upper levels of Bloom's taxonomy to challenge students to think.

Bloom's Taxonomy

1. **Knowledge:** arrange, define, duplicate, how, how much, label, list, memorize, name, order, recognize, relate, recall, repeat, reproduce, state, who, what, why, when.
2. **Comprehension:** classify, demonstrate, describe, discuss, explain, express, identify, indicate, infer, judge, locate, recognize, report, restate, review, select, translate.

PAUL AND ELDER'S ELEMENTS OF REASONING

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3. **Application:** apply, choose, demonstrate, dramatize, employ, explain, illustrate, interpret, operate, practice, predict, schedule, show, sketch, solve, summarize, use, write, "what would happen if?"
4. **Analysis:** analyze, appraise, test calculate, categorize, compare, contrast, criticize, differentiate, discriminate, distinguish, examine, experiment, question, "what conclusions can you make?"
5. **Synthesis:** arrange, assemble, collect, compose, construct, create, design, develop, formulate, "how would you test." manage, organize, plan, prepare, propose, set up, write.
6. **Evaluation:** appraise, argue, assess, attach, choose compare, defend, estimate, find the errors, judge, predict, rate, core, select, support, value, evaluate.

cepts and definitions used, analyzing the assumptions made, analyzing the point of view, comparing, explaining, inferring, analogies, sequencing.

Questions are asked that help students apply, extend and evaluate the concepts or principles - forecasting, generalizing, recognizing implications and consequences, judging, predicting, constructing, generalizing, hypothesizing, extrapolating.

Review questions are asked to review concepts, evaluate student judgments, and the main ideas of the lessons.

All students participate - even if students do not have their hands up.

Students are called on randomly.

"I don't know" is not an acceptable answer - teacher re-directs, restates the question, has another student answer and has the first student summarize that answer, or comes back to the student with another question later in the lesson.

The name of the student comes at the end of the question.

Now Add Socratic Questioning

Basic Questioning Technique Used in *Teaching for Thinking*

Students can read the material aloud, a paragraph or block of text at a time, (if age and lesson appropriate) or they can be questioned over material that has been assigned or they have learned previously.

Visual materials (maps, graphs, tables, etc.) are studied by students for a few minutes before questioning.

Questions are asked that help students make sense of the information or concept - identifying the goal, recognizing the key question or problem, identifying and analyzing the pertinent information, identifying the con-

QUESTIONS TO GUIDE INTELLECTUAL THINKING

RICHARD PAUL AND LINDA ELDER'S LIST OF UNIVERSAL INTELLECTUAL STANDARDS STUDENTS SHOULD LEARN

<http://www.gilbert.k12.az.us/index.html>

Clarity

Could you elaborate further?

Could you illustrate what you mean?

Could you give me an example?

Accuracy

How could we check on that?

How could we find out if that is true?

How could we verify or test that?

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Could you be more specific?

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Relevance

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What factors make this a difficult problem?

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Breadth

Do we need to look at this from another perspective?

Do we need to consider another point of view?

Do we need to look at this in other ways?

Logic

Does all this make sense together?

Does your first paragraph fit in with your last?

Does what you say follow from the evidence?

Significance

Is this the most important problem to consider?

Is this the central idea to focus on?

Which of these facts are the most important?

VIRGINIA STANDARDS OF LEARNING ALIGNMENT WITH INSTRUCTIONAL MODELS

PAUL'S MODEL OF REASONING

Social Studies	Language Arts	Mathematics	Science
<ul style="list-style-type: none"> • Historical analysis 	<ul style="list-style-type: none"> • Analyze and interpret literature 	<ul style="list-style-type: none"> • Qualitative comparisons problems 	<ul style="list-style-type: none"> • Predicting
<ul style="list-style-type: none"> • Multiple perspectives 	<ul style="list-style-type: none"> • Use reasoning developing written forms 	<ul style="list-style-type: none"> • Interpretation of data presentations (e.g. graphs, charts) 	<ul style="list-style-type: none"> • Hypothesizing
<ul style="list-style-type: none"> • Understanding text-based sources (primary and secondary) 	<ul style="list-style-type: none"> • Debate 	<ul style="list-style-type: none"> • Logic and reasoning 	<ul style="list-style-type: none"> • Inferring
<ul style="list-style-type: none"> • Persuasive writing 	<ul style="list-style-type: none"> • Research projects 	<ul style="list-style-type: none"> • Problem solving 	<ul style="list-style-type: none"> • Analyzing and evaluating data

PAUL'S MODEL OF CONCEPT DEVELOPMENT

Social Studies	Language Arts	Mathematics	Science
<ul style="list-style-type: none"> • Economic, legal, government, political systems 	<ul style="list-style-type: none"> • Change in literary elements (e.g. character, plot, setting) 	<ul style="list-style-type: none"> • Pattern recognition and pattern making 	<ul style="list-style-type: none"> • Living and earth/space systems
<ul style="list-style-type: none"> • Structure, function and pattern of societal systems 	<ul style="list-style-type: none"> • Writing process 	<ul style="list-style-type: none"> • Number systems 	<ul style="list-style-type: none"> • Cycles and patterns
<ul style="list-style-type: none"> • Maps as systems 	<ul style="list-style-type: none"> • Language study 	<ul style="list-style-type: none"> • Use of the concepts of models and scale to construct mathematical forms 	<ul style="list-style-type: none"> • Interactions with and across systems
<ul style="list-style-type: none"> • History as the study of change over time 	<ul style="list-style-type: none"> • Grammar as a system 	<ul style="list-style-type: none"> • Communication and connections 	<ul style="list-style-type: none"> • Change processes in biology, chemistry, physics, and geology.

BLOOM'S TAXONOMY OF THE COGNITIVE DOMAIN

Categories in the Cognitive Domain

<http://www.valdosta.peachnet.edu/~whuitt/psy702/cogsys/bloom.html>

Knowledge of terminology:

specific facts; ways and means of dealing with specifics (conventions, trends and sequences, classifications and categories, criteria, methodology); universals and abstractions in a field (principles and generalizations, theories and structures): Knowledge is (here) defined as the remembering (recalling) of appropriate, previously learned information.

Verbs:

defines; describes; enumerates; identifies; labels; lists; matches; names; reads; records; reproduces; selects; states; views.

Comprehension: Grasping (understanding) the meaning of informational materials.

Verbs: classifies; cites; converts; describes; discusses; estimates; explains; generalizes; gives examples; makes sense out of; paraphrases; restates (in own words); summarizes; traces; understands.

Application::

The use of previously learned information in new and concrete situations to solve problems that have single or best answers.

Verbs: acts; administers; articulates; assesses; charts; collects; computes; constructs; contributes; controls; determines; develops; discovers; establishes; extends; implements; includes; informs; instructs; operationalizes; participates; predicts; prepares; preserves; produces; projects; provides; relates; reports; shows; solves; teaches; transfers; uses; utilizes.

Analysis:

The breaking down of informational materials into their component parts, examining (and trying to understand the organizational structure of) such information to develop divergent conclusions by identifying motives or causes, making inferences, and/or finding evidence to support generalizations.

Verbs: breaks down; correlates; diagrams; differentiates; discriminates; distinguishes; focuses; illustrates; infers; limits; outlines; points out; prioritizes; recognizes; separates; subdivides.

Synthesis:

Creatively or divergently applying prior knowledge and skills to produce a new or original whole.

Verbs: adapts; anticipates; categorizes; collaborates; combines; communicates; compares; compiles; composes; contrasts; creates; designs; devises; expresses; facilitates; formulates; generates; incorporates; individualizes; initiates; integrates; intervenes; models; modifies; negotiates; plans; progresses; rearranges; reconstructs; reinforces; reorganizes; revises; structures; substitutes; validates.

Evaluation:

Judging the value of material based on personal values/opinions, resulting in an end product, with a given purpose, without real right or wrong answers.

Verbs: appraises; compares & contrasts; concludes; criticizes; critiques; decides; defends; interprets; judges; justifies; reframes; supports.

TABA QUESTIONING STRATEGY DESIGN

TABA QUESTIONING STRATEGY DESIGN

created by Hilda Taba, based on the work of Piaget

Careful questioning can be used to help students at many different levels and in many different classes progress to higher levels of thinking and understanding. Instructors can plan discussions, moving from a level of simple factual understanding to drawing inferences, applying information to new situations, and eventually to evaluating information. When questioning a group, allow each person to contribute just one response, in order to involve more people.

From I-CANS (Integrated- Curriculum for Achieving Necessary Skills)

<http://www.literacynet.org/icans/chapter02/questions.html>

Level of Question	Thinking Skill	Sample Questions
Deductive Reasoning	Evaluation	<i>Did it work? How successful was it? Were the results as predicted?</i>
Inductive Reasoning	Application (either hypothetical or actual)	<i>Ifthen...? Suppose that...?</i>
	Making generalizations (conceptualization)	<i>What conclusions can you draw?</i>
	Drawing inferences about relationships	<i>Why do you think...?</i>
	Affective Identification	<i>What was your reaction to...? How did it make you feel...?</i>
	Perception	<i>What happened? What do you know about...? What did you see...?</i>
Factual Understanding	Common Experience/ Demonstration	<i>Who...? Where...? When...? Demonstrate what occurred, how to do something, and so on, using props, audio-visual aids, etc.</i> HYPERLINK

TEACHER GUIDE TO USING TABA QUESTIONING STRATEGIES

Opening Question

(Allows many students to enter the discussion):
What did you notice about the distribution of power among the various governmental entities?
Student responses need to be listed on the board.

Lifting Questions

(Directs students to look for relationships among data):
What seems to be reflected in this information?
What might be the reason for this decentralization?

Extension Questions

(Fosters the development of ideas, giving a student a chance to develop his idea):
What might be the result of that?
Well, tell me a little more.

Questions to Lead to Combining of Ideas and Making of Relevant Generalizations

What can you say is generally true about what we have been talking about?
What do you make of all we've been saying here?
What would you consider an important idea that you got from this?

Contributed by Mary Gray from Lane/Benton/ Lincoln ESD 2003

QUESTIONING STRATEGIES FOR INDUCTION FROM HILDA TABA

CONCEPT FORMATION

Overt Activity	Covert Mental Operations	Eliciting Questions
1. Enumeration, listing	Differentiation (identifying separate items)	What do you see? hear? note?
2. Grouping	Identifying common properties, abstracting	What belongs together? On what criterion?
3. Labeling, categorizing	Determining the hierarchical order of things (super- and subordination)	How would you call these groups? What belongs to what?

Source: Hilda Taba, *Teacher's Handbook for Elementary Social Studies* (Reading, Mass.: Addison-Wesley Publishing Co., Inc., 1967) p. 92.

INTERPRETATION OF DATA

Overt Activity	Covert Mental Operations	Eliciting Questions
1. Identifying critical relationships	Differentiating	What did you notice? see? find?
2. Exploring relationships	Relating categories to each other Determining cause-and-effect relationships	Why did this happen?
3. Making inferences	Going beyond what is given Finding implications, extrapolating	What does this mean? What picture does it create in your mind? What could you conclude?

Source: Hilda Taba, *Teacher's Handbook for Elementary Social Studies* (Reading, Mass.: Addison-Wesley Publishing Co., Inc., 1967) p. 101.

APPLICATION OF PRINCIPLES

Overt Activity	Covert Mental Operations	Eliciting Questions
1. Predicting consequences, explaining unfamiliar phenomena, hypothesizing	Analyzing the nature of the problem or situation, retrieving relevant knowledge	What would happen if . . . ?
2. Explaining and/or supporting the predictions and hypotheses	Determining the causal links leading to prediction or hypothesis	Why do you think this would happen?
3. Verifying the prediction	Using logical principles or factual knowledge to determine necessary and sufficient conditions	What would it take for this to be generally true or probably true?

Source: Hilda Taba, *Teacher's Handbook for Elementary Social Studies* (Reading, Mass.: Addison-Wesley Publishing Co., Inc., 1967) p. 109.

PROBLEM SOLVING

The Creative Problem Solving Process <http://www.cpsb.com/>

- **Focusing** - Define, prioritize, focus and analyze problems
- **Idea Generating** - Generating creative and useful ideas, approaches and solutions
- **Decision Making** - Making the best possible decision
- **Implementing** - Ensure that solutions are implemented

Osborn-Parnes Five Stage CPS Model <http://www.buffalostate.edu/centers/creativity/cpsandesc.htm>

- Fact Finding
- Problem Finding
- Idea Finding
- Solution Finding
- Acceptance Finding

Future Problem Solving <http://www.vafps.org/emphasizedskills.html>

- Ability to conduct meaningful research
- Concentration and persistence
- Divergent thinking
- Team work
- Convergent thinking
- Elaboration
- Clarity of written expression
- Independence of thought
- Making cause and effect relationships
- Autonomy and accountability
- Fluency of thought (quantity of ideas)
- Flexibility of thought (variety of ideas)
- Respect for the abilities of others
- Ability to organize and focus on tasks
- Originality
- Appreciation of complexity
- Evaluating ideas
- Time management

Future Problem Solving

http://www.unesco.org/education/tlsf/theme_d/mod23/uncom23bod.htm

Future Problem Solving is a strategy for helping students develop skills for analyzing a problem. Working through a six step process can help them decide - from a futures perspective - what should be done about a problem.

The six steps are:

- identifying possible causes and effects of a problem;
- identifying the underlying problem;
- brainstorming potential solutions;
- developing criteria for evaluating solutions;
- evaluating all solutions to determine the best one; and
- developing an action plan.

Looking for more information? Research E. Paul Torrance and Sid Parnes.

E. P. Torrance: His Life, Accomplishments, and Legacy is a tribute to the renowned creativity researcher, university teacher, and mentor to numerous individuals throughout the world. This monograph is presented in three sections which include a discussion of Torrance's life, followed by an overview of his accomplishments, including his creativity research, the Future Problem Solving Program, and the Incubation Model of Teaching. The monograph concludes with a discussion of his legacy and the Torrance Center for Creative Studies. <http://www.gifted.uconn.edu/hebecram.html>

Sid Parnes: Professor Emeritus, and Founding Director for the Center in Studies of Creativity, Buffalo, NY, and Co-Founder of the Osborne-Parnes Creative Solving Problem Process. <http://www.buffalostate.edu/centers/creativity/cpsandesc.htm>

TYPES OF THINKING

Critical Thinking: using basic thinking processes to analyze arguments and generate insight into particular meanings and interpretations

Critical Thinking Skills

Inductive reasoning - making observations that suggest a conclusion or lead to an hypothesis

Syllogism - 2 or more premises that are used to derive valid conclusions

Deductive reasoning - use of stated premises to draw conclusions that can logically be derived from them

Classification - to sort or group objects, events, or people into clusters according to their common factors, attributes, or characteristics

Sequencing - arranging in a connected series based on a particular property or characteristic

Inferring - to derive a conclusion from facts or premises; to guess, surmise; to reason beyond available information to fill in gaps

Problem solving - using basic thinking processes to define and resolve a difficulty

Patterning - seeking constant traits or replicable characteristics, artistically, mathematically

Analogy - a problem-solving strategy in which linguistic or figural similarities are noted between 2 or more situations, while simultaneously discerning there are also differences in the relationship

Ambiguity - recognizing more than one meaning in a communication **Comparison** - juxtaposing items to establish similarities

Contrasting - to compare objects or ideas by emphasizing their differences

Analysis - seeking relationships such as part/whole, patterns, sequences, order, logical deductions, attributes

Creative thinking: using basic thinking processes to develop or invent novel, aesthetic, constructive ideas or products

Creative Thinking Skills

Fluency - generating multiple responses to a problem, situation, solution

Brainstorming - a group or individual method for generating multiple responses

Flexibility - viewing ideas or solutions from a wide variety of perspectives

SCAMPER - a model to use to become more flexible in thinking. The anagram stands for **S**ubstitute, **C**ombine, **A**dapt, **M**odify-**M**agnify-**M**inify-**P**ut to other uses, **E**liminate, **R**everse

Elaboration - adding details to a creative idea or product; fleshing out with details

Originality - creating a new or novel idea or product; may be on a level of comparison with oneself, with one's age peers, with the world at large

Attribute listing - a method to generate more and different ideas by listing known attributes and then changing or improving them in unusual ways

Metaphor - linguistic comparisons formed when we note similarities between things that are basically dissimilar; often used in creative thinking and writing

Reflective Thinking Skills

Metacognition - conscious knowledge about our thinking processes and how we use them

A RANGE OF QUESTIONS

CLOSED QUESTIONS

Factual Questions

"Who?"
 "What?"
 "Where?"
 "When?"

OPEN-ENDED QUESTIONS OR EXTENSION QUESTIONS

Classification Question

"Can you find at least 3 sets to group these events (objects, characters) in according to common characteristics or attributes?"

Sequencing Questions

"How would you arrange the main events in the story according to the order in which they occurred?"

"Can you place the rocks in your sample in order from softest to hardest?"

"Which of the following historic events occurred in the __ century? Place them in chronological order."

Inference Questions

"What do you know by examining this photograph?"

"What do you know about the character in this selection?"

"What observations did you make that led you to this conclusion? (or hypothesis)"

Cause-Effect Relationships

"What were the causes of..." (historical events, a turn in a literary plot)

Predictions

"The title of the next reading assignment is _____. After seeing that, what do you predict the selection will be about?" (could be a section in a text, a poem, a chapter)

"You have finished chapter ____ in the novel. What do you predict the main character will do in the next chapters?"

Assumptions

"You have observed ____ (an experiment, a character's actions, a picture). What are some assumptions you have made in inferring why the experiment turned out as it did (or why the character acted as he/she did or what is going on in the picture)."

Comparison Questions

"In what ways are ____ (2 historic figures such as Lincoln and Douglas; 2 characters in different novels) similar to each other?"

"How are the settings of these novels similar?"

Contrast Questions

"In what ways are these two ideas about government different?"

"How are the results of your experiments different?"

Point of View

"How did _____ character feel about _____ (circumstance in the story)?"

"Did _____ character see the same happening in the same way? Provide evidence from the text to support your answer."

Interpretation or questions about Hypotheses

"How might Shakespeare have written about this political scandal?"

"How would a modern-day musician (or scientist) interpret this classical piece (or early scientific finding)?"

"How might history have been different if Martin Luther King, Jr. had never delivered his famous 'I have a dream' speech?"

"Based on current social and political issues, what do you think future movies, novels, and plays will be about?"

"Can you support your opinion with a reference to the text?"

"Where else in the selection (or passage) does the author also suggest that ...?"

"According to the author if his passage, should...?"

"Have you ever experienced the character's feelings? When?"

"How do the descriptions of characters in ____ reveal the author's voice?"

"How would the music be different if it were played in a major key, rather than a minor?"

Evaluative questions

"Do you agree or disagree with...?"

"Would you have made the same decision as _____ in these circumstances?"

"What do you think about the ending?"

Clarification questions

"What do you mean by ... ?"

"Please what you mean when you say...."

"How could you explain in your own words what _____ says (means)?"

Support questions

"What is your reasoning?"

"What is your strategy?"

"What evidence do you have?"

ELEMENTS OF THOUGHT —R. PAUL

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Eight elements of thought identified by Richard Paul (1992) are the basic building blocks of productive thinking. Working together, they provide a general logic to reasoning. In literature interpretation and listening, they help one make sense of the reasoning of the author or speaker. In writing and speaking, they enable authors or speakers to strengthen their arguments.

Students are often asked to distinguish between facts and opinions. However, between pure opinion and hard facts lie reasoned judgments in which beliefs are supported by reasons. Instruction in this area needs to be included in all forms of communication in the language arts.

Teachers may use the elements to assist in crafting questions for class discussion of literature or questions for probing student thinking. Examples of such questions are given on the Wheel of Reasoning that follows the descriptions below.

The eight elements of reasoning are as follows:

Purpose, Goal, or End View

We reason to achieve some objective, to satisfy a desire, to fulfill some need. For example, if the car does not start in the morning, the purpose of my reasoning is to figure out a way to get to work. One source of problems in reasoning is traceable to "defects" at the level of purpose or goal. If our goal itself is unrealistic, contradictory to other goals we have, confused or muddled in some way, then the reasoning we use to achieve it is problematic. If we are clear on the purpose for our writing and speaking, it will help focus the message in a coherent direction. The purpose in our reasoning might be to persuade others. When we read and listen, we should be able to determine the author's or speaker's purpose.

Question at Issue (or Problem to Be Solved)

When we attempt to reason something out, there is at least one question at issue or problem to be solved (if not, there is no reasoning required). If we are not clear about what the question or problem is, it is unlikely that we will find a reasonable answer, or one that will serve our purpose. As part of the reasoning process, we should be able to formulate the question to be answered or the issue to be addressed.

For example, why won't the car start? or should libraries censor materials that contain objectionable language?

Points of View or Frame of Reference

As we take on an issue, we are influenced by our own point of view. For example, parents of young children and librarians might have different points of view on censorship issues. The price of a shirt may seem low to one person while it seems high to another because of a different frame of reference. Any defect in our point of view or frame of reference is a possible source of problems in our reasoning. Our point of view may be too narrow, may not be precise enough, may be unfairly biased, and so forth. By considering multiple points of view, we may sharpen or broaden our thinking. In writing and speaking, we may strengthen our arguments by acknowledging other points of view. In listening and reading, we need to identify the perspective of the speaker or author and understand how it affects the message delivered.

Experiences, Data, Evidence

When we reason, we must be able to support our point of view with reasons or evidence. Evidence is important in order to distinguish opinions from reasons or to create a reasoned judgment. Evidence and data should support the author's or speaker's point of view and can strengthen an argument. An example is data from surveys or published studies. In reading and listening, we can evaluate the strength of an argument or the validity of a statement by examining the supporting data or evidence. Experiences can also contribute to the data of our reasoning. For example, previous experiences in trying to get a car to start may contribute to the reasoning process that is necessary to resolve the problem.

Concepts and Ideas

Reasoning requires the understanding and use of concepts and ideas (including definitional terms, principles, rules, or theories). When we read and listen, we can ask ourselves, "What are the key ideas presented?" When we write and speak, we can examine and organize our thoughts around the substance of concepts and ideas. Some examples of concepts are freedom, friendship, and responsibility.

ELEMENTS OF THOUGHT—R. PAUL

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Assumptions

We need to take some things for granted when we reason. We need to be aware of the assumptions we have made and the assumptions of others. If we make faulty assumptions, this can lead to defects in reasoning. As a writer or speaker we make assumptions about our audience and our message. For example, we might assume that others will share our point of view; or we might assume that the audience is familiar with the First Amendment when we refer to "First Amendment rights." As a reader or listener we should be able to identify the assumptions of the writer or speaker.

Inferences

Reasoning proceeds by steps called inferences. An inference is a small step of the mind, in which a person concludes that something is so because of something else being so or seeming to be so. The tentative conclusions (inferences) we make depend on what we assume as we attempt to make sense of what is going on around us. For example, we see dark clouds and infer that it is going to rain; or we know the movie starts at 7:00; it is now 6:45; it takes 30 minutes to get to the theater; so we cannot get there on time. Many of our inferences are justified and reasonable, but many are not. We need to distinguish between the raw data of our experiences and our interpretations of those experiences (inferences). Also, the inferences we make are heavily influenced by our point of view and our assumptions.

Implications and Consequences

When we reason in a certain direction, we need to look at the consequences of that direction. When we argue and support a certain point of view, solid reasoning requires that we

consider what the implications are of following that path; what are the consequences of taking the course that we support? When we read or listen to an argument, we need to ask ourselves what follows from that way of thinking. We can also consider consequences of actions that characters in stories take. For example, if I don't do my homework, I will have to stay after school to do it; if I water the lawn, it will not wither in the summer heat.

Adapted from Paul, R. (1992). *Critical thinking: What every person needs to survive in a rapidly changing world*. Sonoma, CA: Foundation for Critical Thinking.