The Thinker's Guide to

Analytic Thinking

How To Take Thinking Apart And What To Look For When You Do

> The Elements of Thinking and The Standards They Must Meet

By Dr. Linda Elder and Dr. Richard Paul

Based on Critical Thinking Concepts & Tools A Companion to: The Miniature Guide to Critical Thinking Concepts and Tools

The Foundation for Critical Thinking

Contents

Part I: Understanding the Basic Theory of Analysis

This section provides the foundational theory essential to analysis. It delineates the eight basic structures present in all thinking.

Why a Guide on Analytic Thinking?
Why the Analysis of Thinking is Important
All Thinking is Defined by the Eight Elements That Make It Up $\ldots \ldots \ldots 5$
All Humans Use Their Thinking To Make Sense of the World6
To Analyze Thinking We Must Learn to Identify and Question Its Elemental Structures $\ldots\ldots.7$
To Evaluate Thinking, We Must Understand and Apply Intellectual Standards $\dots \dots 8-9$
Thirty-five Dimensions of Critical Thought10–11
On the Basis of the Above We Can Develop A Checklist for Evaluating Reasoning12–13

Part 2: Getting Started: Some First Steps

This section enumerates the most important foundational moves in analysis.

Think About Purpose
State the Question
Gather Information
Watch Your Inferences
Check Your Assumptions
Clarify Your Concepts
Understand Your Point of View
Think Through the Implications

Part 3: Using Analysis to Figure Out the Logic of Anything

This section provides a range of sample analyses (as well as templates for analysis).

The Spirit of Critical Thinking	
Analyzing the Logic of Human Emotions	
Analyzing Problems	
Analyzing the Logic of an Article, Essay, or Chapter	
Analyzing the Logic of a Textbook	
Evaluating an Author's Reasoning	
Analyzing the Logic of a Subject:	
• Science	
• History	
• Sociology	
• Economics	
• Ecology	40–41

Part 4: Taking Your Understanding to a Deeper Level

This section explains the elements more comprehensively, differentiating skilled from unskilled reasoners.

Analyzing and Assessing:

	Goals, Purposes, or Objectives	. 42
	Questions, Problems, and Issues	. 43
	Data, Evidence, Experience, Research	. 44
	Inferences, Interpretations, and Conclusions	. 45
	Assumptions and Beliefs	. 46
	Concepts, Ideas, and Theories	. 47
	Points of View and Perspectives	. 48
	Implications and Consequences	. 49
Di	stinguishing Between Inferences and Assumptions	-51
20	nclusion	. 52

Why a Guide on Analytic Thinking?

Analysis and evaluation are recognized as crucial skills for all students to master. And for good reason. These skills are required in learning any significant body of content in a non-trivial way. Students are commonly asked to analyze poems, mathematical formulas, biological systems, chapters in textbooks, concepts and ideas, essays, novels, and articles—just to name a few. Yet how many students can explain what analysis requires? How many have a clear conception of how to think it through? Which of our graduates could complete the sentence: "Whenever I am asked to analyze something, I use the following model:..."

The painful fact is that few students have been taught how to analyze. Hence, when they are asked to analyze something scientific, historical, literary, or mathematical—let alone something ethical, political, or personal—they lack a model to empower them in the task. They muddle through their assignment with only the vaguest sense of what analysis requires. They have no idea how sound analysis can lead the way to sound evaluation and assessment. Of course, students are not alone. Many adults are similarly confused about analysis and assessment as intellectual processes.

Yet what would we think of an auto mechanic who said, "I'll do my best to fix your car, but frankly I've never understood the parts of the engine," or of a grammarian who said, "Sorry, but I have always been confused about how to identify the parts of speech." Clearly, students should not be asked to do analysis if they do not have a clear model, and the requisite foundations, for the doing of it. Similarly, we should not ask students to engage in assessment if they have no standards upon which to base their assessment. Subjective reaction should not be confused with objective evaluation.

To the extent that students internalize this model through practice, they put themselves in a much better position to begin to think historically (in their history classes), mathematically (in their math classes), scientifically (in their science classes), and therefore more skillfully (in all of their classes). When this model is internalized, students become better students because they acquire a powerful "system-analyzingsystem."

This thinker's guide is a companion to The Miniature Guide to Critical Thinking Concepts and Tools. It supports, and is supported by, all of the other miniature guides in the series. It exemplifies why thinking is best understood and improved when we are able to analyze and assess it EXPLICITLY. The intellectual skills it emphasizes are the same skills needed to reason through the decisions and problems inherent in any and every dimension of human life.

Why the Analysis of Thinking is Important

Everyone thinks; it is our nature to do so. But much of our thinking, left to itself, is biased, distorted, partial, uninformed, or downright prejudiced. Yet the quality of our life and of what we produce, make, or build depends precisely on the quality of our thought. Shoddy thinking is costly, both in money and in quality of life. If we want to think well, we must understand at least the rudiments of thought, the most basic structures out of which all thinking is made. We must learn how to take thinking apart.

All Thinking Is Defined by the Eight Elements That Make It Up

Eight basic structures are present in all thinking: Whenever we think, we think for a purpose within a point of view based on assumptions leading to implications and consequences. We use concepts, ideas and theories to interpret data, facts, and experiences in order to answer questions, solve problems, and resolve issues. Thinking, then:



Each of these structures has implications for the others. If you change your purpose or agenda, you change your questions and problems. If you change your questions and problems, you are forced to seek new information and data. If you collect new information and data...

Essential Idea: There are eight structures that define thinking. Learning to analyze thinking requires practice in identifying these structures in use.

All Humans Use Their Thinking To Make Sense of the World

The words *thinking* and *reasoning* are used in everyday life as virtual synonyms. Reasoning, however, has a more formal flavor. This is because it highlights the inference-drawing capacity of the mind.

Reasoning occurs whenever the mind draws conclusions on the basis of reasons. We draw conclusions whenever we make sense of things. The result is that whenever we think, we reason. Usually we are not aware of the full scope of reasoning implicit in our minds.

We begin to reason from the moment we wake up in the morning. We reason when we figure out what to eat for breakfast, what to wear, whether to make certain purchases, whether to go with this or that friend to lunch. We reason as we interpret the oncoming flow of traffic, when we react to the decisions of other drivers, when we speed up or slow down. One can draw conclusions, then, about everyday events or, really, about anything at all: about poems, microbes, people, numbers, historical events, social settings, psychological states, character traits, the past, the present, the future.

By reasoning, then, we mean making sense of something by giving it some meaning in our mind. Virtually all thinking is part of our sense-making activities. We hear scratching at the door and think, "It's the dog." We see dark clouds in the sky and think, "It looks like rain." Some of this activity operates at a subconscious level. For example, all of the sights and sounds about us have meaning for us without our explicitly noticing that they do. Most of our reasoning is unspectacular. Our reasoning tends to become explicit only when someone challenges it and we have to defend it ("Why do you say that Jack is obnoxious? I think he is quite funny"). Throughout life, we form goals or purposes and then figure out how to pursue them. Reasoning is what enables us to come to these decisions using ideas and meanings.

On the surface, reasoning often looks simple, as if it had no component structures. Looked at more closely, however, it implies the ability to engage in a set of interrelated intellectual processes. This miniature guide is largely focused on making these intellectual processes explicit. It will enable you to better understand what is going on beneath the surface of your thought.

To Analyze Thinking We Must Learn to Identify and Question its Elemental Structures



Be aware: When we understand the structures of thought, we ask important questions implied by these structures.

Essential Idea: Reasoning occurs when we draw conclusions based on reasons. We can upgrade the quality of our reasoning when we understand the intellectual processes that underlie reasoning.

© 2007 Foundation for Critical Thinking

www.criticalthinking.org

© 2007 Foundation for Critical Thinking

www.criticalthinking.org

Analyzing Problems

Identify some problem you need to reason through. Then complete the following:

- What exactly is the problem? (Study the problem to make clear the kind of problem you are dealing with. Figure out, for example, what sorts of things you are going to have to do to solve it. Distinguish problems over which you have some control from problems over which you have no control. Pay special attention to controversial issues in which it is essential to consider multiple points of view.)
- The key <u>question</u> that emerges from the problem is... (State the question as clearly and precisely as you can. Details are very important.)
- My <u>purpose</u> in addressing the problem is... (Know exactly what you are after. Make sure you are not operating with a hidden agenda and that your announced and real purposes are the same.)
- Actively seek the <u>information</u> most relevant to the question. (Include in that information options for action, both short-term and long-term. Recognize limitations in terms of money, time, and power.)
- **Some important** <u>assumptions</u> I am using in my thinking are... (Figure out what you are taking for granted. Watch out for self-serving or unjustified assumptions.)
- If we solve this problem, some important implications are... If we fail to solve this problem, some important implications are... (Evaluate options, taking into account the advantages and disadvantages of possible decisions before acting. What consequences are likely to follow from this or that decision?)
- The most important <u>concepts</u>, theories, or ideas I need to use in my thinking are... (Figure out all significant ideas needed to understand and solve the problem. You may need to analyze these concepts. Use a good dictionary.)
- The <u>point(s) of view</u> is/are as follows: (Know the point of view from which your thinking begins. Be especially careful to determine whether multiple points of view are relevant.)
- After reasoning through the parts of thinking above, the best <u>solution</u> (conclusion) to the problem is... (If the problem involves multiple conflicting points of view, you will have to assess which solution is the best. If the problem is one-dimensional, there may be just one "correct" solution.)
- If I, and many others, fail to reason well through this issue, the <u>implications</u> are that we will unnecessarily contribute to pollution's many harmful effects.

Analyzing Problems

The Problem of Polution as an Example¹

- What is the problem? The problem is pollution and the fact that because people are not doing enough to reduce it, a host of negative consequences are occurring (e.g. increased medical problems, loss of animal and plant life, increased contamination of the earth's water sources).
- <u>Questions</u> that emerge from the problem are... What can I personally do to reduce pollution? A related question is: What can we collectively do to reduce pollution?
- My <u>purpose</u> in addressing the problem is to increase the things I do to contribute to a more healthy biosphere.
- **The important information relevant to the question is** information about what I am currently doing to increase pollution (such as generating trash that could be recycled, driving a car, etc.), information about what I could do to reduce the amount of pollution I contribute to (such as locating recycling centers, pursuing alternative forms of transportation, etc.), information about environmental groups I might support, etc.
- **Some important <u>assumptions</u> I am using in my thinking are** that pollution is causing significant damage to the biosphere, that everyone can help reduce pollution, that I, and everyone else, have an obligation to make a significant effort to help reduce pollution.
- If many people were to reason well through this issue, some <u>implications</u> are that there would be a longer and higher quality of life for millions of people. Additionally, plant and animal species and ecosystems would be protected. A host of other positive implications would follow as well, implications for the atmosphere, the waterways, the forests, etc.
- The most important <u>concepts</u>, or ideas, I need to use in my thinking are the concepts of pollution, and that of a healthy biosphere. Each of these concepts leads to a host of further technical, ecological, and ethical concepts required to understand the multiple dimensions of pollution and the ethical responsibilities that knowledge of its many harmful effects entails.
- My <u>point of view</u> is as follows: I am looking at pollution. I am seeing it as something I can help reduce through many means.
- After reasoning through the parts of thinking above, the best <u>solution</u> (conclusion) to the problem will be to put into action the various options that my research has revealed.

¹ This problem is presented without details and is intended merely to exemplify how one might begin to reason through the logic of a complex question. When using this approach, the more details one includes, the deeper the analysis can be. Many layers of detail could then be specified based on research into all of these levels. For further background information on this particular problem, see the Logic of Ecology (p. 40).

Analyzing the Logic of a Subject

When we understand the elements of reasoning, we realize that all subjects, all disciplines, have a fundamental logic defined by the structures of thought embedded in them.

Therefore, to lay bare a subject's most fundamental logic, we should begin with these questions:

- What is the main <u>purpose</u> or <u>goal</u> of studying this subject? What are people in this field trying to accomplish?
- What kinds of <u>questions</u> do they ask? What kinds of problems do they try to solve?
- What sorts of information or data do they gather?
- What types of <u>inferences</u> or judgments do they typically make? (Judgments about...)
- How do they go about gathering information in ways that are distinctive to this field?
- What are the most basic ideas, <u>concepts</u> or theories in this field?
- What do professionals in this field take for granted or <u>assume</u>?
- How should studying this field affect my view of the world?
- What viewpoint is fostered in this field?
- What <u>implications</u> follow from studying this discipline? How are the products of this field used in everyday life?

These questions can be contextualized for any given class day, chapter in the textbook and dimension of study. For example, on any given day you might ask one or more of the following questions:

- What is our main <u>purpose</u> or <u>goal</u> today? What are we trying to accomplish?
- What kinds of <u>questions</u> are we asking? What kinds of problems are we trying to solve? How does this problem relate to everyday life?
- What sort of <u>information</u> or data do we need? How can we get that information?
- What is the most basic idea, <u>concept</u> or theory we need to understand to solve the problem we are most immediately posing?
- From what point of view should we look at this problem?
- What can we safely <u>assume</u> as we reason through this problem?
- Should we call into question any of the <u>inferences</u> that have been made?
- What are the <u>implications</u> of what we are studying?



Be aware: Many people who have studied science in school fail to think scientifically in their professional and personal lives.

© 2007 Foundation for Critical Thinking

The Logic of History

The Logic of Sociology



Be aware: Much human thinking is "historical." We use our beliefs (formed in the past) to make thousands of decisions in the present and plans for the future. Much of this historical thinking is deeply flawed.

© 2007 Foundation for Critical Thinking

Be aware: Much of our everyday decision-making is based on poor "sociological" thinking. For example, we often uncritically conform to peer groups when we should question them or note their contradictions and inconsistencies.

© 2007 Foundation for Critical Thinking

www.criticalthinking.org

Conclusion

Clearly there are many varieties of analysis specific to particular disciplines and technical practices. These forms of analysis often require technical training of a specialized nature. For example, one cannot do qualitative analysis in chemistry without instruction in chemistry.

What we have provided in this guide, however, is the common denominator between all forms of analysis because all forms require thoughtful application and all thought presupposes the elements of thought. For example, one cannot think analytically FOR NO PURPOSE. Or think analytically, with NO QUESTION in mind. This much should be self-evident. Unfortunately, it is not self-evident to most students.

Those who would develop analytic minds need guidance, instruction, and practice in monitoring their thinking using intellectual tools applicable to every discipline. They need to learn to question purposes, goals, problem definitions, information, concepts, etc... It is these interdisciplinary analytic tools that enable those skilled in them to understand and assess their analytic thinking, whether in a highly technical area or in an everyday personal application. It is these analytic tools that enable one to get at the most fundamental logic of any discipline, subject, problem, or issue. They provide the means for transfer of learning between and among subjects and disciplines. They enable motivated persons to gain an overview of their learning in any and every situation analyzed, to think their way into and out of various intellectual domains.

Of course, there are no magic pills that will create analytic questioning minds. As in any important area of skills and abilities, all learners need to log hundreds of hours to gain command and deep insight. There are no shortcuts. We hope that this thinker's guide will serve as a launching pad toward analytic proficiency. It is admittedly a first step only, but it is an essential, and we believe a powerful, first step. The question is, "Do you have the will and the insight to commit yourself to the long-term practice required?"

Announcing the **3RD INTERNATIONAL**

Academy on Critical Thinking

to be held at

ST. JOHN'S COLLEGE, CAMBRIDGE UNIVERSITY, UK

August 25-28, 2009



Visit www.criticalthinking.org or call 800.833.3645

The Thinker's Guide Library

The Thinker's Guide series provides convenient, inexpensive, portable references that students and faculty can use to improve the quality of studying, learning, and teaching. Their modest cost enables instructors to require them of all students (in addition to a textbook). Their compactness enables students to keep them at hand whenever they are working in or out of class. Their succinctness serves as a continual reminder of the most basic principles of critical thinking.

For Students & Faculty

The Ministrare Guide
Critical Thinking CONCEPTS AND TOOLS
Acceleration
In Task Rise

54

Critical Thinking—The essence of critical thinking concepts and tools distilled into a 22-page pocket-size guide. (1–24 copies \$4.00 each; 25–199 copies \$2.00 each; 200–499 copies \$1.75 each) #520m



Analytic Thinking—This guide focuses on the intellectual skills that enable one to analyze anything one might think about — questions, problems, disciplines, subjects, etc. It provides the common denominator between all forms of analysis. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #595m



Asking Essential Questions—Introduces the art of asking essential questions. It is best used in conjunction with the Miniature Guide to Critical Thinking and the How to Study mini-guide. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #580m



How to Study & Learn—A variety of strategies—both simple and complex—for becoming not just a better student, but also a master student. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #530m



How to Read a Paragraph—This guide provides theory and activities necessary for deep comprehension. Imminently practical for students. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #525m



How to Write a Paragraph—Focuses on the art of substantive writing. How to say something worth saying about something worth saying something about. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #535m

The Ministere Guide	
The Human Mind How it Works Best, How & Goes Wrong	
Ny Cin Jania Haler med Dia Kaland Had	
Annal and could filled any couple and Principles We found with the filled any court of Hadding	

The Human Mind—Designed to give the reader insight into the basic functions of the human mind and to how knowledge of these functions (and their interrelations) can enable one to use one's intellect and emotions more effectively. (1–24 copies \$5.00 each; 25–199 copies \$2.50 each; 200–499 copies \$1.75 each) #570m

Refinier Lan	
Understanding the Transistions of	
Ethical	
Reasoning	
An and a state of the state	

Foundations of Ethical Reasoning—Provides insights into the nature of ethical reasoning, why it is so often flawed, and how to avoid those flaws. It lays out the function of ethics, its main impediments, and its social counterfeits. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #585m



How to Detect Media Bias and Propaganda—Designed to help readers come to recognize bias in their nation's news and to recognize propaganda so that they can reasonably determine what media messages need to be supplemented, counterbalanced or thrown out entirely. It focuses on the internal logic of the news as well as societal influences on the media. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #575m



Scientific Thinking—The essence of scientific thinking concepts and tools. It focuses on the intellectual skills inherent in the well-cultivated scientific thinker. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 20–499 copies \$2.50 each) #590m



Fallacies: The Art of Mental Trickery and Manipulation—Introduces the concept of fallacies and details 44 foul ways to win an argument. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #533m



Engineering Reasoning—Contains the essence of engineering reasoning concepts and tools. For faculty it provides a shared concept and vocabulary. For students it is a thinking supplement to any textbook for any engineering course. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #573m



Critical Thinking for Children—Designed for K–6 classroom use. Focuses on explaining basic critical thinking principles to young children using cartoon characters. (1–24 copies \$5.00 each; 25–199 copies \$2.50 each; 200–499 copies \$1.75 each) #540m

For Faculty

Be Belanders data

Active and Cooperative Learning—Provides 27 simple ideas for the improvement of instruction. It lays the foundation for the ideas found in the mini-guide How to Improve Student Learning. (1–24 copies \$3.00 each; 25–199 copies \$1.50 each; 200–499 copies \$1.25 each) #550m



Critical & Creative Thinkin **How to Improve Student Learning**—Provides 30 practical ideas for the improvement of instruction based on critical thinking concepts and tools. It cultivates student learning encouraged in the How to Study and Learn mini-guide. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #560m

Critical and Creative Thinking—Focuses on the interrelationship between critical and creative thinking through the essential role of both in learning. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #565m



Critical Thinking Reading and Writing Test—Assesses the ability of students to use reading and writing as tools for acquiring knowledge. Provides grading rubrics and outlines five levels of close reading and substantive writing. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #563m



Socratic Questioning—Focuses on the mechanics of Socratic dialogue, on the conceptual tools that critical thinking brings to Socratic dialogue, and on the importance of questioning in cultivating the disciplined mind. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #553m

Critical Thinking Competency Standards— Provides a framework for assessing students' critical thinking abilities. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #555m

Educational Fads Analyzes and critiques educational trends and fads from a critical thinking perspective, providing the essential idea of each one, its proper educational use, and its likely misuse. (1–24 copies \$6.00 each; 25–199 copies \$4.00 each; 200–499 copies \$2.50 each) #583m

The Foundation for Critical Thinking

The Foundation for Critical Thinking seeks to promote essential change in education



and society through the cultivation of fair-minded critical thinking, thinking predisposed toward intellectual empathy, humility, perseverance, integrity, and responsibility. A rich intellectual environment is possible only with critical thinking at the foundation of education. Why? Because only when students learn to think through the content they are learning in a deep and substantive way can they apply what they are learning in their lives. Moreover, in a world of accelerating change, intensifying complexity, and increasing interdependence, critical thinking is now a requirement for economic and social survival.

Contact us online at www.criticalthinking.org to learn about our publications, videos, workshops, conferences, and professional development programs.

"Analytic Thinking" Mini-Guide Price List: (+ shipping and handling) Item #595m 1–24 copies \$6.00 each 25–199 copies \$4.00 each 200–499 copies \$2.50 each 500–999 copies \$1.75 each 1000–1499 copies \$1.50 each

For More Information

(To order guides or to inquire about other resources) Phone: 707-878-9100 Fax: 707-878-9111 E-mail: cct@criticalthinking.org Web site: www.criticalthinking.org Mail: Foundation for Critical Thinking P.O. Box 220 Dillon Beach, CA 94929

© 2007 Foundation for Critical Thinking

About the Authors

Dr. Linda Elder is an educational psychologist who has taught both psychology and critical thinking at the college



level. She is the President of the Foundation for Critical Thinking and the Executive Director of the Center for Critical Thinking. Dr. Elder has a special interest in the relation of thought and emotion, the cognitive and the affective, and has developed an original theory of the stages of critical thinking development. She has authored and co-authored a series of articles on critical thinking including a column on critical thinking for the *Journal of Developmental Education*. She has co-authored four books on critical thinking. She is a dynamic presenter.

Dr. Richard Paul is a major leader in the international critical thinking movement. He is Director of Research at the



Center for Critical Thinking, and the Chair of the National Council for Excellence in Critical Thinking, author of over 200 articles and seven books on critical thinking. Dr. Paul has given hundreds of workshops on critical thinking and made a series of eight critical thinking video programs for PBS. His views on critical thinking have been canvassed in New York Times, Education Week, The Chronicle of Higher Education, American Teacher, Educational Leadership, Newsweek, U.S. News and World Report, and Reader's Digest.

The Foundation for Critical Thinking



www.criticalthinking.org 707-878-9100 800-833-3645 cct@criticalthinking.org ISBN 0-944-583-19-9 Item #595m