



Patterns of Thinking

*Integrating Learning Skills
in Content Teaching*

John H. Clarke

Foreword by Arthur L. Costa



PATTERNS OF THINKING

*Integrating Learning
Skills in Content Teaching*

JOHN H. CLARKE

UNIVERSITY OF VERMONT

Foreword by Arthur L. Costa

Allyn and Bacon

Boston London Toronto Sydney Tokyo Singapore



Copyright © 1990 by Allyn and Bacon
A Division of Simon & Schuster, Inc.
160 Gould Street
Needham Heights, Massachusetts 02194

All rights reserved. No part of the material protected by this copyright notice may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage and retrieval system, without written permission from the copyright owner.

Library of Congress Cataloging-in-Publication Data

Clarke, John H.

Patterns of thinking : integrating learning skills in content
teaching / John H. Clarke.

p. cm.

Includes bibliographical references.

ISBN 0-205-12361-9

1. Thought and thinking—Study and teaching—United States.

I. Title.

LB1590.3.C53

90-31470

370.15'2—dc20

CIP

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1 94 93 92 91 90

PATTERNS OF THINKING

***To Ethan, Jesse, Cindy,
and all the other children***

Foreword

HAVE YOU EVER HEARD YOURSELF SAY TO YOUR OWN child or a student in your class, “Think about it,” or “Think hard”? Have you ever heard yourself or a colleague say, “These students just don’t think”? Interestingly, the term *thinking* is a broad, vague, fuzzy term that has diffuse meanings for different people. Furthermore, students often don’t have the foggiest idea of what we expect from them when we say, “Now *think!*” Do we want them to generate creative new ideas, focus on a task, make connections with past knowledge, explore consequences, or simply guess what’s in our head?

Have you ever asked a student to describe how he or she solved a problem—to discuss the mental steps he or she used in the problem-solving process? Did you receive a blank stare or perhaps a response like, “I don’t know. I just did it.”

The goal of this book is to have students be able to say instead, “Yes, let me show you how I did it.” Furthermore, we’d like them to say, “Let’s compare how I solved it with how others did it,” or “I know some other ways I could do it; let me show you,” or “If I were to find a similar problem elsewhere, here are some ways I would use to solve it.”

It has been said that true intelligent behavior is knowing how to behave when you don’t know the answer to a problem. It is not how many answers you do know; rather, it is how you behave when you don’t know that counts.¹ Helping students know how to behave when they don’t know the answers, therefore, is what education is—or should be—about.

Patterns of Thinking offers a wide range of suggestions for ways to represent complex, covert thought processes—those internal mental manipulations that we all engage in but seldom discuss and rarely illustrate. The intent is to make the covert more overt, the implicit more explicit, the hidden more obvious. As a result, students should become more aware of their own thought processes, more able to entertain a range and repertoire of problem-solving strategies, and, with discussion and visual representation, able to apply them more deliberately and productively to a broader range of life problems that they will encounter.

In this book, the processes of thinking, decision making, and conceptualizing are not only described, they are also graphically represented—displayed metacognition—picturing what goes on in our heads when we think. The intent is to help the student understand, monitor,

and take charge of her or his own thinking abilities. Both students and teachers can become aware of the steps in the thinking process. They can discuss and illustrate what is happening in their heads when they are in the process of problem solving. They can represent an idea in a form that offers permanence to processes that are fleeting. The benefits of such discussion will prove to have a profound effect on students' mental growth. Students will demonstrate greater empathy for each others' point of view; they will acquire a wider repertoire of problem-solving processes; they will gain a sense of efficacy, empowerment, and command of their own thought processes; and they will better understand their own thought processes because they have explained them graphically to others. They will gain a healthy respect for each other when someone else takes the opportunity to listen to an explanation and to analyze a diagram displaying the intricacies of each other's complex thought processes. Powerful stuff!

Furthermore, teachers will listen more and better appreciate how students are processing their reality; how they approach problems in what may seem to be an awkward, inefficient way. By observing students graphically represent their thinking, teachers can better appreciate, mediate, and enhance the productiveness of student thinking because they have presented a "cognitive map" of their thoughts—including the backroads, side trips, excursions, dead ends, and pathways the mind took on their journey to find meaning.

Too often, we teachers view education as something we do to or for students. We sometimes forget that we are also reciprocals of the teaching-learning act. Teachers, too, will learn from this process when they display their thinking. The strategic act of teaching also requires thoughtful planning before, metacognitive awareness during, and reflective analysis after the act of instruction. Teachers who map their own thought processes of teaching will graphically display their strategies of instruction to themselves, to other teachers, and, most importantly, to their students. Strangely, many teachers keep secret from their students their own thought processes about their intended instructional outcomes, their planning procedures, their instructional strategies, and their methods of self-evaluation. Graphically representing them and sharing them with students will invite students to become partners in the teaching-learning process.

Even without training or formal education, the human mind is capable of myriad complex mental processes. Humans are innately endowed with the capacity to compare and contrast, to classify and categorize, to induce and deduce, to retrieve and transfer, to seriate and reverse, to collect data through sensory pathways, to infer and generalize, to find patterns and predict, and to think spatially, numerically, and temporally. Humans do this because they are human, not because they are educated.

Educated humans, however, are not satisfied with the mere perform-

ance of such mental processes. We also have a strong inner desire to perfect those skills. Improvement is in evidence when our cognitive abilities become more broadly applied, more spontaneously generated, more precisely focused, more intricately complex, more metaphorically abstract, and more insightfully divergent. The enlargement of our knowledge base, our continual search into the unknown, our insatiable curiosity, our compulsion to resolve discrepancies, all serve as testimony to this human desire for enhancing, applying, and perfecting our cognitive functioning.

Thus, a distinction between an educated and an uneducated person may not only be in terms of the amount of knowledge acquired, the number of years of schooling, or the number of degrees collected. Rather, a person also may be considered educated because he or she continues to learn how to learn. Lifetimes are spent in the pursuit of knowledge and skills. Our ability to learn from experience, to reflect upon and abstract from our history, and to modify our future actions may well be the definition of an educated human. The capacity for self-modification may be the essential attribute of the autonomous person.

In this universe, there will be the need for a new conception of the educated person as one who is continually self-analyzing, self-evaluating, and self-modifying, continually adapting to change.

Education today must respond to the projected need for this new form of literate citizen for tomorrow's world. This requires the preparation of today's students with the awareness of, the desire for, and the skills of self-modification. I believe this book, in combination with a devoted, skillful teacher and a stimulating curriculum, can contribute greatly to the mediation of students' understanding of problem-solving strategies, the awareness of their own metacognitive functioning, and the application of a range of useful strategies when confronted with problems, the resolution of which are not readily apparent.

Arthur L. Costa, Ed.D.
California State University
Sacramento, CA

Preface

EDUCATION FROM GRADE SCHOOL THROUGH COLLEGE HAS entered yet another crisis period. Calls for reform have pointed out disarray in the curriculum and widespread demoralization among teachers at all levels. Students complain that their studies are not meaningful. *Patterns of Thinking* aims to help teachers develop specific strategies that help students think about subject area content and learn to enjoy managing the work of their minds. A focus on thinking can bring coherence to a curriculum that is badly fragmented. It can provide a common goal to faculty in all subject areas, without undercutting the importance of specific content knowledge. Its purpose is to allow students to derive meaning from their encounter with academic content. *Thinking* is not just another add-on; it is essential to effective learning in all subject areas.

A SHORT LOCAL HISTORY

Thinking Across the Disciplines of the University

I developed a personal interest in thinking skills instruction more than ten years ago while working as an instructional design consultant to the teaching faculty of the University of Vermont. As I worked with university teachers within the narrow frame of the academic disciplines, I began to notice recurring patterns in the way they thought about their subject areas. Sociologists tended to think in similar ways; so did biologists; so did literature teachers. But literature teachers did not think like biologists. When sociologists mentioned “models” for social behavior, biologists looked quite blank; when biologists described “systems” of organisms supporting life, literature teachers appeared to cringe; when literature teachers mentioned evidence supporting a “tone” or “motif” in a piece of writing, teachers of other disciplines turned attention to the coffee urn. Virtually all the college teachers put the “facts” of their own discipline at a subordinate level to governing ideas. Yet, each accused the other disciplines of being “fact dominated.” Higher-level thinking skills may have been a common interest of all of us, but we had no common language that would let us talk about that interest. This book proposes a

graphic language for talking about basic thinking patterns in all the subject areas.

In 1979, I helped organize a seminar for our faculty that enabled them to explain to each other the assumptions about thinking that characterized their disciplines. Called "Teaching Students to Think," the colloquium brought interested faculty to a lounge at noon to eat sandwiches and to talk about thinking. There, a classics professor described connections between thought and language. A chemist showed how a visualization of physical phenomenon could be explored more carefully through the scientific method. An historian talked about laborious induction from primary source material—and the limits of inductive thinking. Literature teachers described making intuitive connections across a great expanse of text that made thinking about literature exciting. Writing teachers talked about the experience of writing and revision as an exploration of thinking. What was clear in the faculty presentations was that we were all able to talk about thinking within the frame of our subject areas—but none of us had ever been asked to do so. Thinking was the common thread that linked all of our work to one purpose.

With support from the academic vice presidents of the New England Land Grant Colleges, we expanded the seminar to include college teachers from all six states in the Northeast region. Meeting in Amherst, Massachusetts, the regional seminars continued for three years, growing to the size of regional conference. The question that brought us together was simple: *What does it mean to "think" within your discipline? How do you help students recognize and practice the skills of thinking appropriate to your subject area?* For all of us, the focus on thinking skills seemed to bring purpose and coherence to our own teaching. Although thinking was a different kind of activity in different disciplines, the focus on thinking brought us together as a regional faculty with a common mission beyond our institutions and specialized concerns. Talking about thinking became a way for us to talk about teaching—our profession.

Thinking Across the K–12 Curriculum

As faculty interest in writing and thinking across the disciplines continued, a group of teachers from several academic departments at the University of Vermont began to recognize the importance of enlarging the discussion to include public school teachers. We saw that we could not succeed in supporting the development of thinking abilities at the college level unless we involved K–12 teachers. Also, several public school teachers in Vermont had already developed innovative programs in thinking and learning skills. To test for wider interest among K–12 teachers, we put together a one-day colloquium, presented jointly by public school teachers and university instructors. When several hundred teachers

showed up from across the state, we decided we needed three more years and set up an Institute in Thinking and Writing Across the Disciplines. The Institute had two components: a summer course on the university campus and individual courses taught during the school year within specific school districts. This book is a result from the work of teachers in the summer institutes and from school improvement projects carried out by teachers during the regular school year.

The examples of thinking skills curriculum in this book were developed by teachers for their own students and subject areas. Since 1982, the College of Education and Social Services at the University of Vermont has linked up with school districts across the state to offer Masters degree programs for teachers within their schools. In the Off-Campus Masters Program, a group of teachers (K-12) from schools within one district take courses together in their own school (see Clarke & Hood, 1984). A program of courses for any district may be targeted at specific regional goals. Each course in a school district requires teachers to design an individual action project aimed at local school improvement. At any one time, 20 to 30 teachers within one district may be carrying out school improvement projects for the local course in which they are all enrolled. In a school district, the cumulative effect of many projects from many teachers over a three-year period may be quite large indeed. In looking through the examples included here, you may have to imagine the scope and power of the projects from which they came.

The examples in this book have a strong regional flavor. Vermont teachers often embed apple picking, sugar making, logging, and other local events in their classes. Hopefully, the unmistakable regional flavor of those examples will provide a constant reminder to the reader that a general thinking skills approach cannot be imported or exported. It must be developed by individual teachers within particular schools for their own students. There is strong national support for integrating thinking in all the content areas. Research will continue to provide new insights and cautionary notes. Over the last ten years, research in human cognition has been active and very productive. No matter what support is available, however, the process of integrating thinking skills with content instruction must be designed and managed at last by the individual teacher. Watching fine teachers from all the grade levels work together to design instruction for their schools inspired the writing of this book.

ACKNOWLEDGMENTS

What does it mean to “think” within your discipline? How do you help students recognize and practice the skills of thinking appropriate to your subject area? Can you design a learning experience for your students that

will show them something about thinking! In response to questions like these, more than 30 teachers, K–12, contributed examples of their materials for this book, designed to promote some aspect of thinking among their students. I will thank them all now but you will meet many of these teachers by name in the chapters that follow. In the process of compiling this book, I have derived the greatest pleasure from being allowed to work with these teachers and to watch some of them practice their profession. I sincerely hope that the brief examples included here will let the reader imagine the talent that all of these people bring to the classroom.

Throughout this period, Ken Hood at the University of Vermont's College of Education and Social Services has provided leadership and unswerving support to me and to the Arts and Sciences faculty who developed the summer institutes, the school-based courses and workshops. I want also to thank the group itself, Toby Fulwiler (English), Lynda McIntyre (Art), Mike Strauss (Chemistry), Herb Leff (Psychology), and Hank Steffens (History) of the Institute on Writing and Thinking Across the Disciplines. It takes considerable courage and conviction to cross the lines of discipline in a university context. I have greatly enjoyed our shadowy association. I would also like to thank Dean Jim Rath for supporting my effort to write the book and helping me think more clearly about evaluation.

I would like to express appreciation to Superintendent Glenn Yankee who helped us bring an early course on Thinking Across the Curriculum to Marshfield, Vermont, our most rural area for a field test. The course then moved to Bristol, Vermont, where Superintendent Jim Lombardo had begun a massive curriculum review and Curriculum Coordinator Judy Carr was organizing support for the teachers in the labors of K–12 curriculum design. I would like to express my appreciation to each of them, as well as my admiration for their approach to school improvement. In its last run before I began writing, the course moved to Missisquoi High School and the region of Swanton, Vermont, on the Canadian border. I would like to thank Superintendent John Robb for his support and Curriculum Coordinator Bill Williams for helping this large group design some truly remarkable curriculum projects.

My task in compiling this book has been to arrange and explain specific examples supplied by teachers and their students to fit a general model for cognition. I have adapted a general frame for thinking developed by Art Costa (1985), who has also provided much encouragement. I have used three books from ASCD as texts for my courses: *Developing Minds: A Resource Book for Teaching Thinking* (Costa, 1985); *Strategic Teaching and Learning: Cognitive Instruction in the Content Areas* (Jones et al., 1987); and Ron Brandt of ASCD Publications allowed an early draft of *Dimensions of Thinking* (1988) to be used as a text in a Burlington Institute, for which I am grateful.

Five talented writers read drafts of chapters or sections and helped

me find my way. Art Costa, then President of ASCD, read sample chapters and suggested ways that I could create a "bridge" from academic applications to intelligent behavior in life itself. "When else do students need to think this way?" he asked. (I have tried to guide the reader toward that question.) Toby Fulwiler read an early draft and gave me encouragement. "Tell the story," he said, "Write the way you talk." (I have kept a "story" for each chapter.) Judy Carr put aside her own writing and work with teachers to read and encourage me as well. "Show what teachers have done," she said. I hope the book celebrates fine teaching. Professor Ann Nevin read carefully and offered close notes. "What does this mean?" she asked. Sometimes I couldn't answer. Nancy Cornell, to whom I am married, gave me the benefit of her ten years of experience as a professional writer to guide me along. "Some days," she said, "That's just the way it goes." (With her support, I have tried to keep going.) Joan Carrassi edited and produced the final manuscript. To all of these people I want to express my thanks.

John H. Clarke
South Starksboro, Vermont

PATTERNS OF THINKING

Contents

Foreword Arthur L. Costa xi

Preface xv

SECTION I *Teaching Thinking* 1

Introduction: Thinking Across the Disciplines 3

Assumptions 6

Making Room for Differences 8

References 9

1 Thinking 11

An Experience in Thinking 12

References 26

2 Teaching 29

Let's See How They Think 30

Looking at Graphic Organizers 36

Using Graphic Organizers in Teaching 39

Getting Started 43

References 46

SECTION II *Frames for Inductive Thinking* 49

3 Inductive Frames in Teaching 51

Inductive Thinking and Learning 53

Errors in Induction 56

Changing Minds in the Subject Areas 58

Graphic Frames for Inductive Learning 59

References 61

4	Scanning and Focusing	63
	An Episode in Focusing	64
	Purposeful Scanning	66
	Strategic Focusing	67
	Drawing and Labeling	68
	Free Writing and Webbing	70
	Time Lines and Story Frames	74
	Grids and Graphs	77
	A Case Study: The Long Stream Profile	80
	Suggestions for Teachers	85
	References	87
5	Developing Categories and Concepts	89
	A Failure of Categories	90
	Revolution among Concepts	92
	Subject Knowledge as a Category System	93
	Representing Categories in Teaching and Learning	94
	Testing for Concept Organization	96
	Circle Diagrams in Teaching	100
	Circle Diagrams in Learning	101
	A Case Study: American Indians	105
	An Expanding Margin of Error	109
	Suggestions for Teachers	110
	References	112
6	Organizing Propositions	115
	Inductive Breakdown: Eleventh Grade	116
	Mapping Induction with Propositions	118
	Building an Inductive Tower	121
	Mapping Propositions in Content Teaching	126
	Gradual Disclosure of the Record	131
	Street Law: A Case Study	135
	What Towers Can Show	140
	Suggestions for Teachers	141
	References	144

SECTION III *Frames for Deductive Thinking* 145

7	Deductive Frames in Teaching	147
	Thinking Deductively	149
	Schema Theory: Patterns of Organization for Knowledge	152
	What Schemata Can Do	154

The Power of Schemata	155
Teaching Deductive Thinking: Concept Maps, Causal Chains, and Flowcharts	156
Mapping What They Know	157
References	160

8 Mapping Concept Networks 163

Meateaters from Space: A Struggle with Concepts	164
A Purpose for Concept Mapping	166
Pre- and Postmapping: Assessing the Structure of Knowledge	169
Concept Mapping in Teaching: Creating Structure for Knowledge	176
Using Concept Maps to Guide Thinking	181
Shakespeare for Everyone: A Case Study	187
Suggestions for Teachers	192
References	195

9 Modeling Causal Relations 197

Boiling Events Down to Causes: An Episode	200
Levels of Causal Thinking	202
The Development of Abstract Causal Thinking	206
Teaching Causal Chain Mapping	208
Analytic Backmaps: Making Causal Chains That Explain Events	211
Forward Chaining: Causal Mapping to Predict or Control	216
Hypothetical Cause/Effect Thinking: Planning and Decision Making	218
Deciding: The Suffering Button	219
A Case Study: Forward Chaining from an Inductive Tower	222
Suggestions for Teachers	226
References	227

10 Planning to Solve Problems 231

A Problem Solving Episode: Do It! Do It Again! Do It Harder!	232
Novices in Problem Solving	234
Making Experts from Novices	235
Activating Induction and Deduction: If/Then Rules	237
The Role of Representation in Problem Solving	239
Using Graphic Organizers to Teach Problem Solving	241
Procedural Mapping: Writing Scripts	244
From Scripts to Flowcharts: Making Them Experts	245
Using Flowcharts to Guide Learning	253
From Induction to Deduction in Science: A Case Study	255
Suggestions for Teachers	262
References	264