CONTENTS

Foreword . . . . . *vii*
Acknowledgments . . . . . *ix*
Introduction . . . . . *xi*

CHAPTER 1 Cognitive Research 1

CHAPTER 2 Pedagogical Theory 35

CHAPTER 3 Theories of Intelligence 57

CHAPTER 4 Cooperative Group Learning 87

CHAPTER 5 Collaborative Skills 109

CHAPTER 6 Thinking Skills 125

CHAPTER 7 Graphic Organizers 167

CHAPTER 8 Assessment 207

Glossary *241*
Bibliography *247*
Index *255*

INTRODUCTION

ABOUT THIS BOOK

This book is about designing learning experiences that combine the best of what we know about how the brain learns with the best of what we know about teaching. Our primary goal is to make sense of the wealth of information that exists and condense it into a format that is both teacher friendly and practical.

There is a growing sense of frustration among teachers regarding the sheer number of educational innovations that bombard them on a regular basis. We believe this frustration will be decreased when teachers can make sense of the mass of information by focusing on a limited yet powerful set of research-based instructional strategies.

In the first two chapters we delve into the research of how the brain learns based on the works of Robert Sylwester, Gerald Edelman, Daniel Goleman, Marian Diamond, Renate Nummela Caine, Geoffrey Caine, and Pat Wolfe and then establish a link between this information and current educational theories as proposed and described by Howard Gardner, David Perkins, Jacqueline Brooks, Martin Brooks, Robin Fogarty, Jay McTighe, and Art Costa. Using cognitive research and pedagogical theories, we have developed a set of skills and strategies that fall under the general rubric of brain-compatible instruction.

In chapter 3, we examine three theories of intelligence: multiple intelligences (Gardner 1983), emotional intelligence (Goleman 1995), and intelligent behavior (Costa 1995). We include suggestions for applying the theories to classroom practice.

In chapters 4 and 5, we discuss cooperative group learning and collaborative skills, which are presented as master strategies that facilitate the implementation of all the other teaching suggestions in this book.

Chapters 6 and 7 cover thinking skills and graphic organizers. For the purpose of clarity, these are presented as separate topics, however, in practice they often are used in combination with each other.

The final chapter provides suggestions for assessment in the brain-compatible classroom. It includes tips on how to use alternate forms of assessment, such as projects, performances, and portfolios, establishing criteria, and using assessments to promote student growth.

In effect, we have created a tool kit for teachers that contains a comprehensive set of best teaching practices. Many of these strategies are familiar to teachers—some may have been forgotten, others may not have been used in a while. This book calls the strategies back into mind, organizes them, provides a rationale for their use, and gives some suggestions for integrating them into the classroom.

The strategies in the tool kit may be transferred to the classroom by using a framework for designing brain-compatible learning through lesson planning. The framework is designed so that all the strategies are on display at all times during the lesson design process. This is to remind us of the range of options available, therefore increasing the chances that we will use an expanded repertoire of instructional skills in our day-to-day teaching.

The public, in general, and parents, in particular, are sometimes skeptical of educational innovation. Oftentimes this is because no one has explained the innovations to them or has failed to provide enough information to make clear the purpose of the innovations. As teachers, we often are so busy implementing new ideas that we do not have time to achieve a thorough understanding of the research that supports them. This can lead to situations where we are at a loss to define what we are doing and why we are doing it. For this reason, we have organized the information in each chapter under three general headings: What Is It?, Why Do We Need It?, and How Do We Do It?

The What Is It? section of each chapter introduces the key concepts related to the chapter topic, provides a working definition of the skills or strategies, and presents research findings related to these ideas.

The Why Do We Need It? section provides the rationale for the skills or strategies and states why they are important and how they are connected to the concept of brain compatibility. The importance of the rationale cannot be overstated, because it is as important to understand *why* we are adopting a particular strategy as it is to know how to do it.

The How Do We Do It? section provides a step-by-step approach to using particular skills as well as examples of how they may be applied in the classroom.

Blackline masters are provided in several chapters and may be reproduced for use with your students.

Note the glossary and bibliography for clarification of strategies and brain-related terms and additional readings.

A FRAMEWORK FOR DESIGNING BRAIN-COMPATIBLE LEARNING

It is our contention that by focusing on a limited set of teaching strategies and combining them in many different ways, teachers can design learning experiences that conform more closely with the ways in which the brain learns best.

Our organizing metaphor for this is the painter's palette (see fig. 0.1). Our use of the painter's palette is a metaphor for flexibility, which is the key to lesson design. The palette is the mixing board on which lessons are designed. The different colored tubes of paint are the instructional strategies, or tools, to use in the lessons.

Artists seldom use paint straight from the tube; similarly, teachers do not plan lessons according to a rigid or lock-step formula. Lesson design is similar to painting in that it is a process of mixing and matching. The basic colors are selected and then combined to provide a variety of shades, hues, and tints. The paint is then thoughtfully applied to the canvas. Sometimes we apply a wash of one color with a broad brush, as in whole class instruction. Other times, we may use a fine brush and apply painstaking attention to detail. In other cases, a few bold strokes may get the message across. By holding the palette metaphor in mind, we can see how a relatively small, but wisely selected set of colors can be mixed and applied in an endless variety of ways.

In practice, the framework for designing brain-compatible learning is much more stylized than a painter's palette. Each lesson is comprised of elements, or phases of a lesson, that increase the chance for successful learning (see fig. 0.2). All strategies are multiage and generic. This means that they can be applied at all levels from kindergarten to high school and to all areas of the curriculum. Figure 0.3 shows an overview of instructional strategies.

CHAPTER 1

COGNITIVE RESEARCH

WHAT IS IT?

Much of what is known about how the brain learns has been discovered in the past twenty-five years. For the first time, scientists are able to examine the internal organization and working of the brain as opposed to merely observing the external behavior that results from brain activity. The advent of brain imaging technology has provided a window into the skull that allows scientists and researchers to observe how and where information is manipulated in the process we call learning. The CAT (computerized axial tomography) scan can create a graphical three-dimensional image of the brain. The PET (positron-emission tomography) scan can monitor the pattern of blood flow to various parts of the brain and allows observers to see which parts "light up" as the brain processes information.

Cognitive researchers are just beginning to understand how the brain interacts with the external environment to acquire information, to manipulate and process it, to store it as memory, and to retrieve it on demand. Educators, neuroscientists, cognitive psychologists, and researchers such as Renate Nummela Caine, Geoffrey Caine, Marian Diamond, Gerald Edelman, Howard Gardner, Jane Healy, Eric Jensen, Robert Sylwester, and Pat Wolfe have provided a variety of theories of how the brain learns.

The Brain Is Like . . .

The organization and functions of the brain are predicated on a number of very complex ideas. One way to understand these complex ideas is through the use of metaphors and analogies. These comparisons afford us a place to begin our understanding of the brain, and although they provide somewhat distorted representations, they give us approximations that simplify complex ideas.