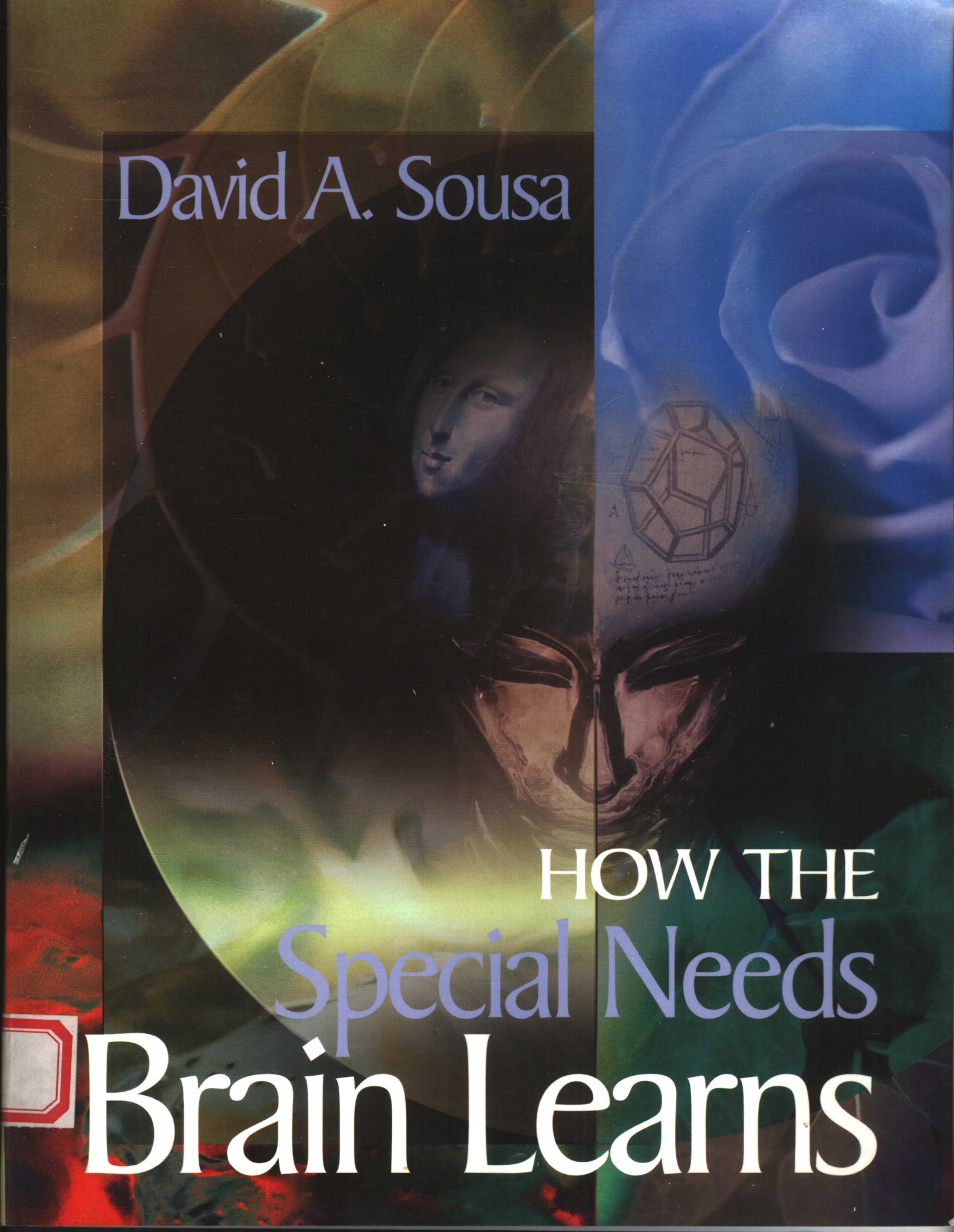

David A. Sousa

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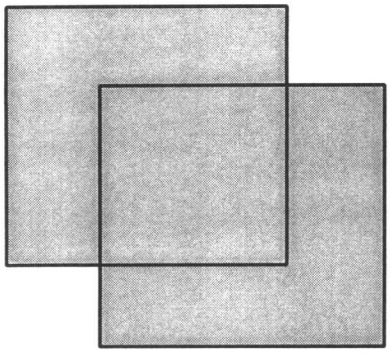

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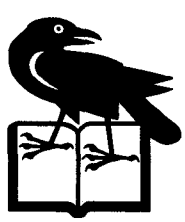
He has been interviewed on the NBC *Today* show and on National Public Radio about his work with schools using brain research. He makes his home in Florida.



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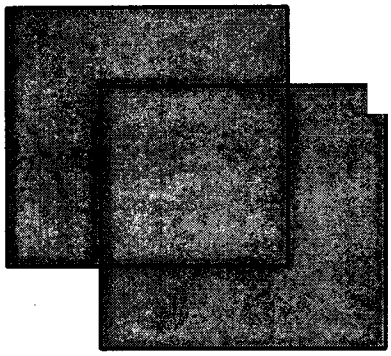

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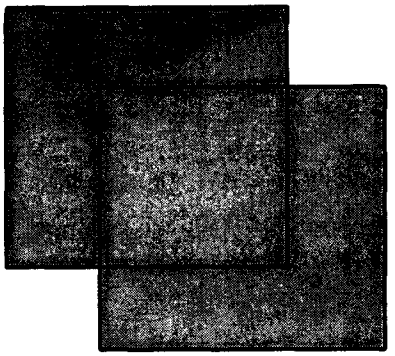


INTRODUCTION

Teachers and students get up every school-day morning hoping to succeed. That hope is not always realized because many factors exist that affect the degree of success or failure in a teaching and learning situation. Some of these factors are well beyond the control of the teacher and the school staff. What teachers *do* control, of course, are the decisions they make about what to teach and about how to present the lesson so that student learning is most likely to occur. In making these decisions, teachers draw on their knowledge base and experience to design activities, ask questions, and respond to the efforts of their students.

Educators are finding themselves searching for new strategies and techniques to meet the needs of an ethnically, culturally, and socially diverse student population. Some tried-and-true strategies do not seem to be as successful as they were in the past, and more students seem to be having difficulty acquiring just the basic skills of reading, writing, and computation. The number of public school students being diagnosed with specific learning disabilities is growing. The total public school population classified as having specific learning disabilities between the 1988-89 and 1997-98 school years rose from 4.90 to 5.91 percent, a 20.6 percent increase (USDE, 1999).

This situation is generating frustration in different parts of the educational community. As a result, educators are searching for new approaches, parents are seeking alternative schooling formats (charter schools and vouchers), and legislators are demanding more standards and testing. It remains to be seen whether any of these efforts will result in more effective services to students with special needs.

Meanwhile, more students diagnosed with learning disabilities are being mainstreamed into regular classrooms and teachers continue to search for new ways to help these struggling students achieve. The percentage of students classified with specific learning disabilities who receive instruction in regular classrooms between the 1988-89 and 1995-96 school years rose from 17.6 percent to 42.4 percent, a dramatic 141 percent increase. As more students with learning

difficulties are mainstreamed into regular classes, general education teachers are finding that they need help adjusting to the added responsibility of meeting the varied needs of these students. Consequently, special education teachers will need to collaborate more than ever with their general education colleagues on ways to differentiate instruction in the mainstreamed classroom.

General and special education teachers will need to collaborate more than ever on ways to differentiate instruction.

Who Are Special Needs Students?

For the purposes of this book, the term "special needs" refers to students

- diagnosed and classified as having specific learning problems, including speech, reading, writing, and mathematics disorders
- enrolled in Title I programs
- not classified for special education nor assigned to Title I, but still struggling with problems affecting their learning, such as those with sleep deprivation

The term does not refer to students with learning problems resulting primarily from hearing, visual, or physical handicaps, or from economic or environmental disadvantage.

Can Brain Research Help?

Teachers may face significant challenges when meeting the needs of children who have learning problems. Trying to figure out what is happening in the brains of these children can be frustrating and exhausting. Until recently, science could tell us little about the causes of learning disorders and even less about ways to address them successfully.

The nature of the difficulties facing students with learning problems vary from maintaining focus, acquiring language, learning to read and write, solving mathematical problems, and remembering important information, to just plain staying awake. Thanks to the development of imaging and other technologies, neuroscientists can now look inside the live brain and, as a result, are gaining new knowledge about its structure and functions. Some of this research may reveal enough clues to help guide the decisions and practices of educators working with students who have special needs.

Because of the efforts of scientists over the years to cure brain disorders, we know more about troubled brains than we do about healthy ones. Early ventures into the brain involved extensive risks which were justified by the potential for curing or improving the patient's condition. But now, essentially risk-free imaging technologies (such as functional magnetic resonance imaging) are giving us greater knowledge about how the normal brain works. For instance, a program created in 1999, called the Interagency Education Research Initiative (IERI), has been established to fund scientific research to study the brain activity of children with and without learning disabilities. IERI is a joint project of the National Science Foundation, the U.S. Department of Education, and the National Institute of Child Health and Human Development. The initiative supports a variety of programs. One study, based at the University of Texas at Houston, uses brain imaging technology to detect the activity patterns in the brains of kindergartners as they learn to read. Researchers meet periodically to discuss their progress and results. IERI's goal is to establish a new research community that uses the results of hard science to influence educational decisions and practice (Viadero, 2001).

Another promising approach to working with diverse learners is being directed by the National Center for Accessing the Curriculum (NCAC). Funded by the Office of Special Education and Programs in the U.S. Department of Education, the NCAC focuses on Universal Design for Learning (UDL), an evolving approach that combines brain research and a digitized curriculum to provide individualized and differentiated instruction in the classroom. Teachers can use the technology to ease the burden of selecting multiple UDL teaching strategies that address different learning styles, abilities, and disabilities in a variety of learning contexts. Although no universally designed curriculum is currently available, NCAC is encouraging publishers to develop digital companions for all printed curriculum materials that they publish.

Because all students with learning problems comprise such a heterogeneous group, no one strategy, technique, or intervention can address all their needs. Today, more than ever, neuroscientists, psychologists, computer experts, and educators are working together in a common crusade to improve our understanding of the learning process. Comparing the functions of brains without deficits to the functions of brains with deficits is revealing some remarkable new insights about learning and behavioral disorders. Some of the findings are challenging long-held beliefs about the cause, progress, and treatment of specific learning disorders. Educators in both general and special education should be aware of this research so that they can decide what implications the findings have for their practice.

Comparing the functions of brains without deficits to the functions of brains with deficits is revealing some remarkable new insights about learning and behavioral disorders.

What Is in This Book?

This book provides research information about common learning disabilities to prospective and current teachers and administrators so that they may consider alternative instructional approaches. Basic brain structures and their functions, as well as a brief description of learning and retention are the subjects of the first chapter. The second chapter provides an overview of factors that can affect brain development and a general discussion of learning disabilities. Subsequent chapters focus on specific learning difficulties, ranging from attention disorders to autism. Putting it all together is the purpose of the final chapter, which summarizes the types of interventions that can address the learning difficulties found in today's classrooms.

Practical applications of the research can be found in the chapter sections called *Strategies to Consider*, which suggest how educators might translate the research into school and classroom practice so that students with learning difficulties can be more successful. Obviously, some of the strategies would be appropriate for all learners. However, the suggestions have been written specifically to address the special needs of students with learning difficulties.

The book will help answer such questions as:

- How different are the brains of today's students?
- What kinds of strategies are particularly effective for students with learning disabilities?
- What progress is brain research making in discovering the causes of different learning disorders?
- Will brain research help us make more accurate diagnoses of learning problems?
- Can schools inadvertently exacerbate ADHD-like behavior in students?
- Can students with native language problems learn a second language?
- How does the brain learn to read?
- How much does lack of sleep affect student performance in schools?
- How can we address the emotional needs of students in the classroom?
- What more do we know about autism?

Some of the information and suggestions found here came from advocacy organizations, including the National Institute of Mental Health, the National Information Center for Children and Youth With Disabilities, and the Learning Disability Association of America (see the resources section). Where possible, I have sought out original medical research reports, and these

are included in the references section of the book. A few of the strategies are derived or adapted from the second edition of my previous book, *How the Brain Learns*, also published by Corwin Press.

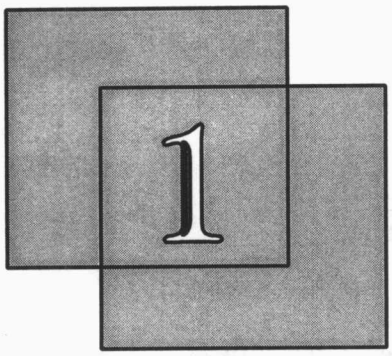
This book is not intended to be a comprehensive text describing all the types of barriers that can affect learning. Rather, it focuses on the common difficulties and disorders that any teacher is likely to encounter in the general or special education classroom. On a broader scale, the updates on research and some of the suggested strategies may benefit all who work to educate children.

As we gain a greater understanding of the human brain, we may discover that some students designated as "learning disabled" may be merely "schooling disabled."

As we gain a greater understanding of the human brain, we may discover that some students designated as "learning disabled" may be merely "schooling disabled." Sometimes, these students are struggling to learn in an environment that is designed inadvertently to frustrate their efforts. Just changing our instructional approach may be enough to move these students to the ranks of successful learners. My hope is that this book will encourage all school professionals to learn more about how the brain learns so that they can work together for the benefit of all students.

A Word of Caution

Several chapters contain lists of symptoms that are used to help identify specific disorders. The symptoms are included only for informational purposes and they should not be used as a basis for diagnosis. Any individual who exhibits persistent learning problems should be referred to qualified clinical personnel for assessment.



How the Brain Learns

The human brain is an amazing structure. At birth, it is equipped with over 100 billion nerve cells designed to collect information and learn the skills necessary to keep its owner alive. Although comparatively slow in its growth and development compared to the brains of other mammals, it can learn complex skills, master any of over 6,000 languages, store memories for a lifetime, and marvel at the glory of a radiant sunset. Early in life, the brain's cells grow and connect with each other—at the rate of thousands per second—to store information and skills. Most of the connections result in the development of neural networks that will help the individual successfully face life's challenges. But sometimes, certain connections go awry, setting the stage instead for problems.

To understand the complexity of human brain growth and development, let's review some basic information about its structure. For our purposes, we will first look at major parts of the outside of the brain (Figure 1.1): the frontal, temporal, occipital, and parietal lobes; the motor cortex; and the cerebellum. Although the minor wrinkles are unique in each brain, several major wrinkles and folds are common to all brains. These folds form a set of four lobes in the largest part of the brain, called the *cerebrum* (Latin for brain). Each lobe specializes in performing certain functions.

The frontal lobe contains almost 50 percent of the volume of each cerebral hemisphere and is often referred to as the executive control center. The temporal lobe is the speech center. Visual processing is the main function of the occipital lobe, while the parietal lobe is responsible for sensory integration and orientation. Table 1.1 lists the functions of the four lobes as well as of the motor cortex.

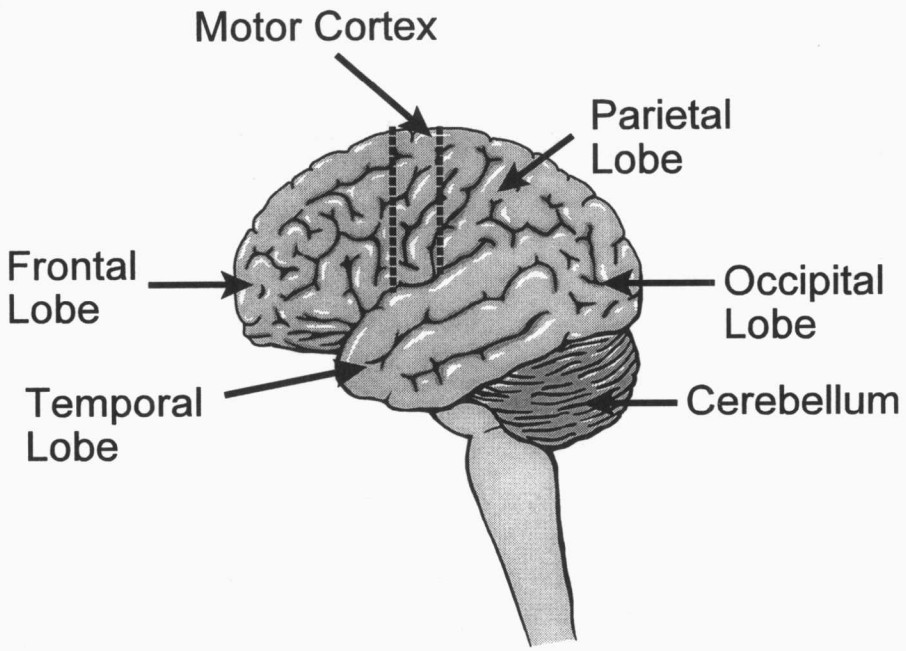


Figure 1.1 *This diagram shows the four major lobes of the brain (cerebrum) as well as the motor cortex and the cerebellum.*

Table 1.1 Some Exterior Parts of the Brain

	Structure	Function
Cerebrum	Frontal Lobe (often referred to as the *executive control center*)	Personality, curiosity, planning, problem solving, higher-order thinking, and emotional restraint
	Temporal Lobe	Interpretation of sound, speech (usually on the left side only), and some aspects of long-term memory
	Occipital Lobe	Visual processing
	Parietal Lobe	Orientation, calculation, and certain types of recognition
	Motor Cortex	Control of body movements

Next, we will look at the inside of the brain and at some of its major structures (see Figure 1.2). Table 1.2 lists the functions of some of the interior parts of the brain: the brain stem, limbic area, cerebrum, and cerebellum.