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Introduction

David A. Sousa

You hold in your hands a historical publication. This book is the first to bring together some of the most influential scholars responsible for giving birth to a new body of knowledge: *educational neuroscience*. This newborn's gestation period was not easy. Lasting for several decades, it was difficult and often contentious. Identifying the parents was elusive at best, as more than a few prominent candidates denied kinship. Just naming the offspring was a daunting challenge and more exhausting than herding cats. Nevertheless, the birth occurred recently with the help of the visionaries who have contributed to this book. And teaching will never be the same again.

The birth of educational neuroscience occurred with the help of the visionaries who have contributed to this book. And teaching will never be the same again.

For centuries, the practice of medicine was an art form, driven by creativity and hope, but with little understanding of how to cure disease. Physicians tried certain treatments and administered specific herbs or potions based largely on their previous experiences or on advice from colleagues. They did not know why some treatments worked on one individual and not another, or why they worked at all. Their practice was essentially trial and error, with an occasional stroke of luck. All that changed when Alexander Fleming discovered penicillin in 1928. Although it took more than a decade for penicillin to be mass produced, it gave physicians their first drug for fighting several serious diseases. Furthermore, by understanding how penicillin disrupted the reproduction of bacteria, physicians could make informed decisions about treatment. Medical practice was not just an art form, but had also crossed the threshold into the realm of a science.

Today, a similar story can also apply to teaching. Teachers have taught for centuries without knowing much, if anything, about how the brain works. That was mainly because there was little scientific understanding or credible evidence about the biology of the brain. Teaching, like early medicine, was essentially an art form. Now, thanks to the development of imaging techniques that look at the living brain at work, we have a better understanding of its mechanisms and networks. Sure, the brain remains an enormously complex wonder that still guards many secrets. But we are slowly pulling back the veil and gaining insights that have implications for teaching and learning.

Until recently, teaching, like early medicine, was essentially an art form.

Since the 1990s, educators all over the world have come to recognize that there is a rapidly increasing knowledge base about the human brain. Through numerous articles, books, videos, and other presentations, they have also become aware that some of this knowledge could inform educational practice. What many educators may not realize, however, is that researchers and practicing educators have worked diligently to establish a legitimate scientific area of study that overlaps psychology, neuroscience, and pedagogy. The result is educational neuroscience (see fig. I.1).

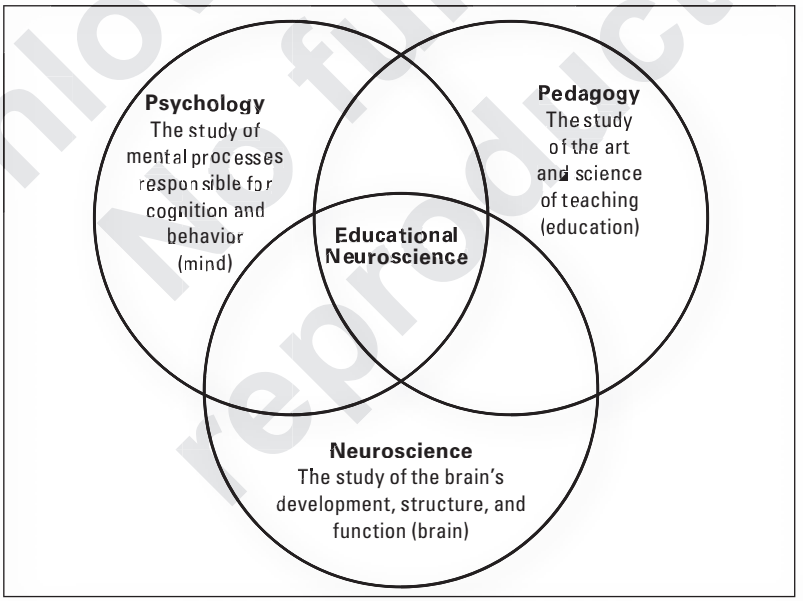

Figure I.1: The emergence of educational neuroscience at the intersection of psychology, neuroscience, and pedagogy.

Chapter 1

How Science Met Pedagogy

David A. Sousa

No one can say exactly when the area of study now known as educational neuroscience was born. Rather, the domain emerged slowly after at least four decades of research on the brain and amid heated battles between well-intentioned parties who held drastically different views about the application of neuroscientific discoveries to educational practice. To understand why these conflicting views developed, it is helpful to review how advances in brain research and imaging technology forever changed cognitive psychology and neuroscience.

Scientific Developments

Psychologists, of course, have been studying the brain for over a century. Behavioral psychologists made inferences about brain function by watching how people responded to certain stimuli (remember Pavlov and his dogs?). Cognitive psychologists drew conclusions about brain growth and development by watching how and when children acquired certain skills. Neurologists had to infer brain function by looking at case studies in which a patient's behavior changed as a result of some sort of brain trauma, such as stroke, lesion, or hemorrhage. But those studying the brain at that time had to face one inescapable fact: the only way they could actually look at a human brain was in an autopsy. In an autopsy, one can learn about the location and size of various brain structures, but nothing about their true function. Even