Cognitive Development and Learning

IN INSTRUCTIONAL CONTEXTS

James P. Byrnes

Cognitive Development and Learning in Instructional Contexts

THIRD EDITION

James P. Byrnes

Temple University

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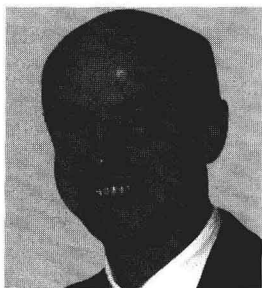
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For Julia and Tommy,
whose development inspires me
and affection sustains me.

About the Author

James Byrnes received his Ph.D. in developmental psychology from Temple University in 1985. Prior to his return to Temple as professor in the Psychological Studies in Education Department in 2004, he held academic appointments at the City University of New York (postdoctoral fellow, 1985–1986), the University of Michigan, Ann Arbor (visiting assistant professor, 1986–1988) and the University of Maryland (assistant through full professor, 1988–2004). In 2006, he assumed the position of associate dean for academic affairs in the College of Education at Temple. He has served as vice-president of the Jean Piaget Society and currently serves as associate editor of the *Journal of Cognition and Development*. He is a fellow of Division 15 (Educational Psychology) of the American Psychological Association and has received grant funding from the National Science Foundation, National Institutes of Health, and the U.S. Department of Education. He has received awards for his teaching and mentoring of undergraduate and graduate students. He has published over sixty books, chapters, and articles on several different areas of cognitive development (e.g., logical reasoning, math learning), but his most recent work has primarily focused on developing comprehensive theoretical models of adolescent decision-making and academic achievement. The model of academic achievement has been specifically designed to provide insight into ways to eliminate or substantially reduce gender, ethnic, and racial gaps in achievement.

Preface

In 1989, I developed a course at the University of Maryland called Cognitive Development in School Contexts in which I organized the psychological literature on reading, writing, math, science, and social studies into a developmental perspective. I believed at that time and believe even more strongly now that teacher preparation programs should be *centered in* developmental theory and research. Instead of spending lots of time explaining instructional techniques and spending very little time thinking about developmental trends in school-related learning and motivation, I believe equal time should be given to methods and educationally relevant developmental research. The goal of that original course was to give preservice and practicing teachers insight into age changes in specific subject areas and developmental mechanisms that could explain these changes. In addition, I wanted them to become familiar with contemporary theories of learning, higher-order thinking, and motivation. Finally, I wanted teachers to become aware of persistent and puzzling gender and ethnic differences in school achievement. Because no one book covered all of these topics in 1989, I was motivated to write this book. As far as I can tell, the present edition is still the only book that considers all of these traditional educational psychology topics from a developmental perspective.

Goals of This Book

I want to equip teachers, principals, policy-makers, parents, and students with the knowledge they need to be effective problem-solvers about educational issues. I say more about this in Chapter 1, but my premise is that one can only solve a learning or motivation problem (e.g., too few children in your school perform at grade level) if one knows the cause of this problem. Informing readers of this book about the inner workings of the mind is similar to teaching a car mechanic about the inner workings of car engines or teaching physicians about the inner workings of the body. Car mechanics need to be intimately familiar with the workings of an engine in order to know how to fix a problem when it occurs. Physicians cannot cure an ailment if they do not know how various organs and tissues work. In the same way, a teacher cannot solve learning or motivation problems without knowledge of how the mind works. Presenting an instructional method to a teacher without giving him or her knowledge of the mind is like presenting a drug therapy to a physician without explaining how the drug operates within the body. The more mysterious a therapy or instructional program is (e.g., It works, but I don't know why), the more likely it is to be used ineffectively or inappropriately.

Of course, there are many other students and professionals who would benefit from the information in this book. For example, most developmental psychologists are generally unfamiliar with the research that has examined development in school subjects like math or reading. Relatedly, most cognitive development books devote a single chapter (if that) to school-related learning. The opposite can be said about traditional books in educational psychology. Although many of the ideas contained in this book also appear in traditional educational psychology texts (e.g., theories of memory and motivation), developmental ideas are relegated to a single chapter. Thus, the present book serves as a useful complement or alternative to traditional cognitive development and educational psychology texts. In addition, undergraduates, graduate students, and parents will benefit from the information presented in this book because it is intended to enhance their metacognition about school-related learning and motivation. Knowing how the mind works is useful information for students who face their own problems in school (e.g., Why do I find it hard to learn calculus?) and useful for parents as they try to help their children solve school-related problems.

Scientific Basis of the Work

The view of the mind presented in this book is grounded firmly in research; that is, I have only included claims about the mind that are supported by sound empirical studies conducted by developmental, educational, or cognitive psychologists. Too often, educators are swayed by approaches that sound good but are not supported by credible data. In fact, officials in the federal government are now moving toward only funding programs in the schools that have a scientific basis. My emphasis on data sometimes led me to go against the prevailing consensus in some educational circles. In other words, I decided to omit a popular approach or topic from my book when it had no supporting data. In most cases, however, the educational community has created important reforms that are based on the research that I describe in my book.

New to the Third Edition

The current edition differs from previous editions in several significant ways. The changes reflect both developments in the field and changes in my own understanding of the factors that are responsible for achievement. The goal of the book is still the same, however: to help educators make informed decisions about the best ways to present material in order that students might better understand it, use it to solve real problems, and retain it over long periods. In terms of updating, I located all articles published since 2001 in the top journals of the fields of developmental, cognitive, and educational psychology and summarized those that had direct relevance in three areas: (1) general theories of learning, memory, motivation, problem solving, and intelligence; (2) domain-specific theories in the areas of math, science, reading, writing, and social studies; and (3) individual, gender, and ethnic differences in achievement.

In addition to including these recent studies, I also revised the organization of content in the following ways. First, my reading of the educational literature suggested that higher-order thinking is no longer the prominent issue that it was when the first edition of this book was published in 1996. Rather than devote an entire chapter to this topic, I moved the discussion of higher-order thinking to the theories chapter (Chapter 2). More specifically, to the list of six questions that were posed to each theory in previous editions (e.g., What is the nature of knowledge?), I added a new question on the theory's stance toward higher-order thinking. I filled the void left by relocating higher-order thinking to another chapter with new sections on contemporary theories and research on the topic of problem solving (see Chapter 4). The chapter on problem solving still retains the important discussion of the problem of transfer, but the section on expertise theory was expanded and moved to an entirely new chapter on intelligence, aptitude, and expertise (see Chapter 6). The need for such a chapter derived from my ongoing and long-standing interest in identifying the most powerful predictors of achievement. As I explain in Chapter 6, intelligence and aptitude help to explain why some children show more pronounced knowledge growth during an academic year than other children in the same classroom. Intelligence and aptitude also are included as components of a new comprehensive theory of achievement presented in Chapter 13, which explores gender and ethnic differences.

Other useful changes include the addition of new case studies for analysis and end-of-section summaries to help the reader pause and take stock of the information presented. Instructors using this book are also strongly encouraged to access the large collection of videos available at Allyn & Bacon's mylabschool.com to supplement the cases presented in the book.

Chapter 1 presents a useful description of how information in all of the chapters can provide insight into the "inner workings" of students' minds. My goal in providing this information is to help educators understand common problems such as student misconceptions, student forgetting, lack of motivation, and reasons for gender and ethnic differences in achievement. Instructors using this book should regularly return to the arguments in Chapter 1 to remind their students of the utility of the information for making informed decisions about how to teach and which curricular packages to select. This book explains why certain techniques and packages work when they do, and also helps provide insight into why certain techniques and packages do not work. I included portions of the Preface from the second edition because the history and logic of this text are still relevant today.

Acknowledgments

As always, I am grateful for the support and intellectual insights of my colleagues at my previous institution (the University of Maryland, College Park) and current institution (Temple University). Some of those at Temple who deserve special mention include Dean Kent McGuire and Drs. Jennifer Cromley, Joe Ducette, Joe Rosenfeld, Cathy Fiorello, Barbara Wasik, Ken Thurman, Michael Smith, Kristie Jones, James Davis, and Heidi Ramirez. I am also grateful to my family (Barbara, Julia, and Tommy) for allowing me time

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