



Edited by
Daniel J. Moran and Richard W. Malott

Evidence-Based Educational Methods



A Volume in the Educational Psychology Series

Evidence-Based Educational Methods

This is a volume in the Academic Press

EDUCATIONAL PSYCHOLOGY SERIES

Critical comprehensive reviews of research knowledge, theories, principles, and practices

Under the editorship of Gary D. Phye

Evidence- Based Educational Methods

Daniel J. Moran

*MidAmerican
Psychological Institute
Joliet, Illinois*

Richard W. Malott


*Department of Psychology
Western Michigan University
Kalamazoo, Michigan*



ELSEVIER
ACADEMIC
PRESS

Amsterdam • Boston • Heidelberg • London
New York • Oxford • Paris • San Diego
San Francisco • Singapore • Sydney • Tokyo

Elsevier Academic Press
525 B Street, Suite 1900, San Diego, California 92101-4495, USA
84 Theobald's Road, London WC1X 8RR, UK

This book is printed on acid-free paper. 

Copyright © 2004, Elsevier Inc. All rights reserved.

No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopy, recording, or any information storage and retrieval system, without permission in writing from the publisher.

Permissions may be sought directly from Elsevier's Science & Technology Rights Department in Oxford, UK: phone: (+44) 1865 843830, fax: (+44) 1865 853333, e-mail: permissions@elsevier.com.uk. You may also complete your request on-line via the Elsevier homepage (<http://elsevier.com>), by selecting "Customer Support" and then "Obtaining Permissions."

Library of Congress Cataloging-in-Publication Data

Application submitted

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

ISBN: 0-12-506041-6

For all information on all Academic Press publications
visit our Web site at www.academicpress.com

Printed in the United States of America
04 05 06 07 08 09 9 8 7 6 5 4 3 2 1

For all teachers and students, especially Jen, my dearest teacher,
and Harmony and Loudon, my cherished students

DJM

For Fred and Lillian Malott

RWM

This Page Intentionally Left Blank

Contents

Contributors xix

Preface xxiii

1

Introduction to Evidence-Based Educational Methods

1. THE NEED FOR EVIDENCE-BASED EDUCATIONAL METHODS

Daniel J. Moran

Introduction	3
No Child Left Behind	4
Behavior Analysis and Education	5

2. REVIEWING THE OUTCOMES AND PRINCIPLES OF EFFECTIVE INSTRUCTION

Laura D. Fredrick and John H. Hummel

Introduction	9
Precision Teaching	14
Direct Instruction	15
Programmed Instruction	17

Personalized System of Instruction	18
Emphasis on the Written Word	19
Self Pacing	19
Mastery	20
Proctors	20
Lectures for Motivation or Reinforcement	20
Summary and Conclusion	21

3. A REAL SCIENCE AND TECHNOLOGY OF EDUCATION

R. Douglas Greer and Dolleen-Day Keohane

Introduction	23
The Need for a Strategic Science of Instruction	25
Components of an Advanced and Sophisticated Science and Technology of Instruction	28
Cabas [®] : A Systems Technology of Schooling and a Strategic Science of Pedagogy	37
Conclusion	41

2

Precision Teaching

4. PRECISION TEACHING: FOUNDATIONS AND CLASSROOM APPLICATIONS

*Charles Merbitz, Doreen Vieitez, Nancy Hansen Merbitz,
and Henry S. Pennypacker*

Why Precision Teaching?	47
The Chart	49
Example of Precision Teaching Implementation	50
Read a Chart	50
Chart Features	52
Prediction	53
Relative Emphasis	53
Wide-Range Display	54
Another Chart Example: Middle School	55
Learning/Celeration	58

Precision Teaching's Place in Teaching and Education	59
Ethics and Precision Teaching Measures in Schools	60

5. PRECISION TEACHING: APPLICATIONS IN EDUCATION AND BEYOND

Charles Merbitz, Doreen Vieitez, Nancy Hansen Merbitz, and Carl Binder

Introduction	63
Precision Teaching and Special Education	66
Precision Teaching for Adult Learners in College and Pre-Vocational Training	68
Precision Teaching Applications for Individuals with Various Disabilities	70
Precision Teaching with Thoughts, Urges, and Other "Inner" Phenomena	74
Precision Teaching, Computers, and Internet Resources	74
Conclusions	76

3

Direct Instruction

6. DIRECT INSTRUCTION: THE BIG IDEAS

Timothy A. Slocum

Introduction	81
Teaching Generalizable Strategies	82
Instructional Programs that Powerfully and Systematically Build Skills	83
Clear and Explicit Instruction	83
Sequence of Instruction	84
Provide Initial Support, Then Gradually Reduce Support	84
Provide Sufficient Practice and Mastery Criteria	85
Provide Clear Instructions to Teachers	86
Tracks	86
Organize Instruction to Maximize High-Quality Instructional Interactions	87
Placement	87

Flexible, Skill-Based Grouping for Efficient Instruction	88
High Rates of Overt and Active Engagement	89
Provide Effective Corrections	90
Research Related to Direct Instruction	91

7. TEACHER-MADE SCRIPTED LESSONS

John H. Hummel, Martha L. Venn, and Philip L. Gunter

Introduction	95
Definition of Explicit Instruction	95
Scripted Lessons	96
Orient and Review	97
Presentation of New Content	98
Practice	99
Model	100
Probes and Checks	101
Formal Assessments	101
Independent Practice	105
Exams	105
Distributed Practice	105
Positive Outcomes of Scripted Lessons	106

8. THE COMPETENT LEARNER MODEL: A MERGING OF APPLIED BEHAVIOR ANALYSIS, DIRECT INSTRUCTION, AND PRECISION TEACHING

Vicci Tucci, Daniel E. Hursh, and Richard E. Laitinen

Introduction	109
Applied Behavior Analysis and The Competent Learner Model	112
What repertoires need to be developed or weakened?	112
What stimuli are available to affect change in behavior?	113
What contingencies are required to develop or weaken the repertoires?	113
How can the parts of instructional conditions be arranged and rearranged to develop the competent learner repertoires?	114
Direct Instruction and the Competent Learner Model	114
Precision Teaching and the Competent Learner Model	117
The Components of the Competent Learner Model	117
The CLM Course of Study	117
Coaching	118
Collaborative Consultation	118
Evidence of the Impact of the Competent Learner Model	121

4

Computers and Teaching Machines

9. EFFECTIVE USE OF COMPUTERS IN INSTRUCTION

Marcie N. Desrochers and G. David Gentry

Introduction	127
What are the Types of Instructional Software?	128
Tutorial	128
Drill-and-Practice	128
Simulations	129
What are the Features of Effective Instructional Software?	130
Antecedents for Desired Behavior	130
Behavior: Active and Frequent Student Responding	131
Consequences: Feedback for Student Responses	132
What Makes Software Design Effective?	132
Navigational Aids	132
Presentation Style and Organization Structure	133
Distinctiveness of Information	133
Text Characteristics	133
What is the Evidence for the Effectiveness of Automated Instruction?	134
Meta-Analytic General Results	135
Specific Meta-Analytic Findings	136
How Should Particular Instructional Software be Evaluated?	137
Content	137
Outcomes	137
Generalization	137
Conclusions	138

10. ADAPTIVE COMPUTERIZED EDUCATIONAL SYSTEMS: A CASE STUDY

Roger D. Ray

Undergraduate Teaching in the Modern University	143
Undergraduate Teaching in Small Liberal Arts Colleges	145
Computers and Adaptive Instruction	149
Adaptive Control, Teaching, and Learning	151
Adaptive Instruction	151

Adaptive Testing	153
Mediamatrix and its Current Use in Higher Education	154
Tutor Level One: Fully Supported Shaping of Reading Comprehension Skills	155
Tutor Level Two: Successive Approximations to Less Prompted Learning	156
Tutor Level Three: Further Development of Verbal Associate Networks	157
Tutor Level Four: Full Development of Verbal Associate Networks	158
How the Probe Mode Works	159
More on Adaptive Programmed Instruction: Parametrics of How Mediamatrix Works	159
Assess and Certification Modes	159
Instructor Options for Managing Student Contact with the Tutoring System	160
Empirical Research on Mediamatrix Delivered Adaptive Instruction	161
Higher Education's Four Horsemen of its Apocalypse	165
Conclusion	168

11. SELECTED FOR SUCCESS: HOW HEADSPROUT READING BASICS™ TEACHES BEGINNING READING

T. V. Joe Layng, Janet S. Twyman, and Greg Stikeleather

Introduction	171
Key Skills and Strategies Students and Teachers' Best Friends	172
Learning Methodologies: Foundational and Flexible	175
Embracing the Burden of Proof: Headsprout's Unparalleled Learner Testing	178
Enabling Evolution: Headsprout's Recombinant Teaching and Engineering Models	182
Headsprout's Internet Advantage: Broad Availability and Continuous Improvement	183
Headsprout Reading basics: Empirical Data	183
Instructional Adaptability	184
Learner Performance Data	184
Reading Outcomes	185
Demonstrated Effective	192
Educator Feedback	192
Conclusion	195

5

Personalized System of Instruction

12. THE PERSONALIZED SYSTEM OF INSTRUCTION: A FLEXIBLE AND EFFECTIVE APPROACH TO MASTERY LEARNING

Eric J. Fox

Introduction	201
History and Overview	202
Key Features of PSI	203
The Rise of PSI	204
The Fall of PSI	205
Effectiveness	206
Flexibility	208
Implementing PSI in the 21st Century	209
Deciding To Use PSI	210
Key Features of PSI: Updated and Revised	211
Conclusion	216

13. MAKING THE MOST OF PSI WITH COMPUTER TECHNOLOGY

Joseph J. Pear, Toby L. Martin

Introduction	223
Computers in Higher Education	224
A Brief History of CAPSI	224
How CAPSI Utilizes Computer Capabilities	225
Information-Processing Capabilities	226
Data Storage Capabilities	229
Communications Capabilities	229
Refinements of CAPSI	230
Higher-Order Thinking	230
Incentives for Student Behavior	234
Plagiarism	235
Preventing Mastery-Criterion Circumvention	235
Training	236
Programming CAPSI	237
The Peer Review System at Work	237

Comparison with Traditional Courses	241
Comparison with Other Computer-Mediated Courses	241
Expanding on Technology	242
Research Studies on CAPSI	242

6

Significant Developments in Evidence-Based Education

14. THE MORNINGSIDESIDE MODEL OF GENERATIVE INSTRUCTION: AN INTEGRATION OF RESEARCH-BASED PRACTICES

Kent Johnson and Elizabeth M. Street

About Morningside Academy	247
Current Work	248
Morningside Teachers' Academy	249
External Partnerships	249
Summer School Institute (SSI)	249
Morningside Technology Transfer	249
Philosophical and Empirical Underpinnings	250
Generativity and Contingency Adduction	251
A System of Instruction	252
Establishing Objectives and Analyzing Content	252
Content-Dependent Analysis	253
Content-Independent Analysis	253
Instructional Program Development	254
Critical Thinking and Self-Regulation	259
Self-Direction and Independence	260
Program Placement and Monitoring Based on Continuous Measurement of Performance	261
Classroom Management	262
Empirical Data Supporting Technology Transfer of the Morningside Model of Generative Instruction	263
Conclusion	264

15. LEARNING EFFICIENCY GOES TO COLLEGE

Guy S. Bruce

Introduction	267
What is Learning Efficiency?	268
Three Possible Causes of Poor Learning Efficiencies and Their Solutions	269
Case Study: Evaluating Learning Efficiencies in a CPSY 101 Course	270
What the Data Can Tell us about How to Improve Learning Efficiencies	272
Learning Efficiency Goes to College	274

16. TEACHING THE GENERIC SKILLS OF LANGUAGE AND COGNITION: CONTRIBUTIONS FROM RELATIONAL FRAME THEORY

Yvonne Barnes-Holmes, Dermot Barnes-Holmes, and Carol Murphy

Introduction	277
Relational Frame Theory	279
Defining Derived Relational Responding	279
Relational Framing	281
Research in Relational Frame Theory and its Implications for Education	283
Derived Transformations of Function in Accordance with Symmetry	283
Teaching Derived Manding	284
Establishing the Relational Frames of More-Than, Less-Than, and Opposite	287
Relational Responding and Perspective Taking	290
Summary and Conclusions	292

17. KEY INSTRUCTIONAL COMPONENTS OF EFFECTIVE PEER TUTORING FOR TUTORS, TUTEES, AND PEER OBSERVERS

*R. Douglas Greer, Dolleen-Day Keohane, Katherine Meincke,
Grant Gautreaux, Jo Ann Pereira, Mapy Chavez-Brown, and Lynn Yuan*

Introduction	295
Responding, Engagement, and an Effective Teacher Measure	297
New Experimental Analyses of Components of Effective Tutoring:	
Brief Reports of Five Studies	301
Study 1	301
Study 2 (Experiments 1 and 2)	308

Study 3	314
Study 4	318
Study 5	323
General Discussion	330

18. TRAINING PROFESSIONALS USING SEQUENTIAL BEHAVIOR ANALYSIS

Tom Sharpe, Daniel Balderson, and Hosung So

History and Introduction	335
Technology	337
A Sequential Analysis Illustration	338
Providing a Database	338
Scientific Methods	340
Participants and Setting	340
Dependent Measures	341
Observation Protocol	342
Inter-Observer Agreement	343
Experimental Design	343
General Instructional Feedback Strategy Procedures	344
Treatment Implementation Training	344
Treatment Integrity	346
Study Results	347
IO and AIA Data	347
OO and AOA Data	347
Discrete Pupil Data	351
Social Validation Data	354
Implications for Education and Professional Training	354
A Future for Sequential Behavior Analysis	357

19. GRAMMAR AND WRITING SKILLS: APPLYING BEHAVIOR ANALYSIS

Marilyn B. Gilbert

Neglected Writing Skills	361
Methods of Teaching Writing	362
Writing as a Performance	364
The Behavioral Paradigm	364
Behavioral Strategies	365
Shaping	366
Measurement	366
Short-Term Feedback	366

Contents	xvii
Long-Term Feedback	367
Discrimination Training	367
Competition Analysis	370
The Process of Writing	371
A Last Word	373

This Page Intentionally Left Blank

Contributors

Daniel Balderson (335), Department of Educational Leadership, University of Nevada—Las Vegas, Las Vegas, Nevada 89154

Yvonne Barnes-Holmes (277), Department of Psychology, National University of Ireland Maynooth, Maynooth, County Kildare, Ireland

Dermot Barnes-Holmes (277), Department of Psychology, National University of Ireland Maynooth, Maynooth, County Kildare, Ireland

Carl Binder (63), Binder Riha Associates, Santa Rosa, California 95404

Guy S. Bruce (267), Community Psychology, Behavior Analysis Program, St Cloud State University, St Cloud, Minnesota 56301

Mapy Chavez-Brown (295), Columbia University Teachers College and Graduate School of Arts and Sciences, New York, New York 10027

Marcie N. Desrochers (127), Bachelor's Program in Behavioral Psychology, School of Human Studies and Applied Arts, St Lawrence College, Brockville, Ontario, Canada, K6V 5X3

Eric J. Fox (201), Arizona State University, Tempe, Arizona 85281

Laura D. Fredrick (9), Department of Educational Psychology and Special Education, Georgia State University, Atlanta, Georgia 30303

Grant Gautreaux (295), Columbia University Teachers College and Graduate School of Arts and Sciences, New York, New York 10027

G. David Gentry (127), Department of Psychology, College of Charleston, Charleston, South Carolina 29424

Marilyn B. Gilbert (361), The Performance Engineering Group, Bainbridge Island, Washington 98110

R. Douglas Greer (23, 295), Columbia University Teachers College and Graduate School of Arts and Sciences, New York, New York 10027

Philip L. Gunter (95), College of Education, Valdosta State University, Valdosta, Georgia 31698

John H. Hummel (9, 95), Department of Psychology and Counseling, Valdosta State University, Valdosta, Georgia 31698

Daniel E. Hursh (109), Department of Advanced Educational Studies, West Virginia University, Morgantown, West Virginia 26506

Kent Johnson (247), Morningside Academy, Seattle, Washington 98109

Dolleen-Day Keohane (23, 295), Columbia University Teachers College, New York, New York 10027

Richard E. Laitinen (109), Tucci Learning Solutions, Inc., Aptos, California 95003

T. V. Joe Layng (171), Headsprout, Seattle, Washington 98102

Richard W. Malott, Western Michigan University, Kalamazoo, Michigan 49008

Toby L. Martin (223) University of Manitoba, Winnipeg, Manitoba, Canada R3T2N2

Katherine Meincke (295), Columbia University Teachers College and Graduate School of Arts and Sciences, New York, New York 10027

Charles Merbitz (47, 63) Institute of Psychology, Illinois Institute of Technology, Chicago, Illinois 60616

Nancy Hansen Merbitz (47, 63), Private Practice, Glen Ellyn, Illinois 60137

Daniel J. Moran (1), MidAmerican Psychological Institute, Joliet, Illinois 60432

Carol Murphy (277), Department of Psychology, National University of Ireland Maynooth, Maynooth, County Kildare, Ireland

Joseph J. Pear (223), University of Manitoba, Winnipeg, Manitoba, Canada R3T2N2

Henry S. Pennypacker (47), MammaCare, Gainesville, Florida 32601

Jo Ann Pereira (295), Columbia University Teachers College and Graduate School of Arts and Sciences, New York, New York 10027

Roger D. Ray (143), Department of Psychology, Rollins College, Winter Park, Florida 32789

Tom Sharpe (335), Department of Educational Leadership, University of Nevada—Las Vegas, Las Vegas, Nevada 89154

Timothy A. Slocum (81), Utah State University, Logan, Utah 84321