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HELPING PEOPLE LEARN

Educational theory and practice are historically influenced by the view of behavioral psychologists that learning is synonymous with behavior change. *Helping People Learn* argues for the practical importance of an alternate view: that learning is synonymous with a change in the meaning of experience. Based on the foundations of cognitive psychology and constructivist epistemology, this book presents a science of education that can guide the development of successful and meaningful educational programs. It serves as a sequel to the best-selling *Learning How to Learn* and includes ideas developed through the author's research and training programs conducted over the past thirty years. It emphasizes the power of the knowledge representation tool "concept maps," designed to facilitate meaningful learning and creativity. This book capitalizes on the advances in technology and is of interest to students, professionals, and researchers in educational psychology and learning theory.

JOSEPH D. NOVAK is Senior Research Scientist Emeritus at the Florida Institute for Human and Machine Cognition (IHMC) and Professor Emeritus at Cornell University. He is the author or contributing author of 40 books and more than 150 research papers. He has made significant contributions in educational psychology and science education.

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University Printing House, Cambridge CB2 8BS, United Kingdom

One Liberty Plaza, 20th Floor, New York, NY 10006, USA

477 Williamstown Road, Port Melbourne, VIC 3207, Australia

314–321, 3rd Floor, Plot 3, Splendor Forum, Jasola District Centre, New Delhi – 110025, India

103 Penang Road, #05–06/07, Visioncrest Commercial, Singapore 238467

Cambridge University Press is part of the University of Cambridge.

It furthers the University's mission by disseminating knowledge in the pursuit of education, learning, and research at the highest international levels of excellence.

www.cambridge.org
Information on this title: www.cambridge.org/9781108470896
DOI: 10.1017/9781108625982

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First published 2022

A catalogue record for this publication is available from the British Library.

Library of Congress Cataloging-in-Publication Data
NAMES: Novak, Joseph D. (Joseph Donald), author.
TITLE: Helping people learn / Joseph D. Novak, Cornell University and Florida Institute for Human and Machine Cognition.
DESCRIPTION: New York, NY : Cambridge University Press, [2022] | Includes bibliographical references and index.
IDENTIFIERS: LCCN 2022012588 | ISBN 9781108470896 (hardback) | ISBN 9781108456838 (paperback)
SUBJECTS: LCSH: Learning, Psychology of. | Education–Philosophy. | Educational psychology. | Climatic changes–Social aspects. | BISAC: PSYCHOLOGY / General
CLASSIFICATION: LCC LB1060 .N676 2022 | DDC 370.15/23–dc23/eng/20220503
LC record available at https://lccn.loc.gov/2022012588

ISBN 978-1-108-47089-6 Hardback
ISBN 978-1-108-45683-8 Paperback

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Preface

In some ways, this book had its origins in 1979–1980. In a conversation with Professor Joel Mintzes at the University of North Carolina – Wilmington, in 1980, I mentioned that I was looking for a good place to spend my next sabbatical leave in the coming academic year working on a new book.

Joel was also the first Ph.D. student of Darryl Murray, my first Ph.D. student at Purdue University, so he was both familiar with my work and interested in collaborating with me professionally. Sabbatical leave arrangements were made, and we spent several months of the 1980–1981 academic year in an ocean front condominium we owned on Carolina Beach. The sabbatical leave arrangements proved to be helpful in other ways, and Joel Mintzes and I became lifelong associates.

I used copies of the first draft of the text in my Learning to Learn course that I first introduced in 1978 at Cornell University. It was later published by Cambridge University Press in 1984, and subsequently in several other languages. The book drew heavily on my experiences with teaching that course. It also drew on the theoretical foundations I had presented in my 1977 book, *A Theory of Education* (Novak, 1977a). The latter book, published by Cornell University Press, drew upon work done by my research teams and visiting professors, as well as a graduate course I called "Theory and Method of Education." I continued to teach both of these courses until 1995 when I retired from my position at Cornell University. I had invited my colleague, D. Bob Gowin, to co-author *Learning How to Learn*, and we continued our collaboration until his retirement in 1993.

My wife, Joan, had open heart surgery in January, 1994, and she thought she would do better spending winters in an area that is warm, flat, and at sea level. I had begun doing some consulting work with Procter & Gamble in Cincinnati, Ohio, and I could continue this work from any location in the country. I thought the theory, principles, and tools we had developed could also be employed successfully in other organizational settings.

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I thought that retirement from Cornell University could provide opportunities to work in many other organizational settings to help people learn. As you will see in this book, this aspiration proved to be very successful.

As I was considering possible universities for my 1987–1988 sabbatical leave, I had a chance conversation with a former Ph.D. student from Cornell University, Bruce Dunn, a professor in the Psychology Department at the University of West Florida (UWF). Bruce suggested that funding might be available for me if I were to spend my sabbatical at his university. Bruce had assembled electroencephalographic (EEG) equipment to study brain activity. I thought it would be interesting to see how EEG patterns differed when subjects were working with different types of concept maps. UWF is about twenty miles from Pensacola Beach, a beautiful Gulf Coast place to live and work for the academic year, and I chose to accept the UWF position of Visiting Research Professor.

Kenneth Ford, a close friend of Bruce Dunn, joined the faculty of Computer Science in the fall of 1988. We soon became acquainted, and Ken became intrigued with the possibility of using concept maps to characterize expert knowledge, one of the difficult problems in the field of artificial intelligence. *Concept maps* are a knowledge representation and learning tool we developed in my research program at Cornell University in the early 1970s. A local cardiologist, Dr. Roberts, had developed a machine for diagnosing coronary defects. The problem was that he had difficulty training other cardiologists to use his equipment. Ken formed a team to concept map Dr. Roberts' diagnostic ideas and strategies. The training program developed using these concept maps proved to be very successful. This led to contracts with all branches of the military, NASA, NSA, and a number of other organizations. Ken had developed the Institute for Human and Machine Cognition (IHMC) to serve as the administrative unit for all of these projects.

The 1980s saw the explosive development of the personal computer. Ken saw the need for high-quality software to make it easier to construct and utilize concept maps in a wide variety of applications. In 1990 Ken brought in a longtime friend, Professor Alberto Cañas, to lead the team to develop what became known as CmapTools software. I am deeply indebted to Alberto and his teams for creating this wonderful software, now used all over the world. This process is described in Chapter 2 of this book. The software is available to anyone at no cost at: http://cmap.ihmc.us/.

When the World Wide Web was developed in the later 1990s and early 2000s, IHMC became a leader in developing software that would facilitate the use of information from the World Wide Web. CmapTools provided for gathering digital resources from the Internet, or any other source, and

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moving these into the files for concept maps, making these essentially a knowledge portfolio. This opened up many new opportunities for the use of this tool in helping people in all organizations gather, organize, and use creatively this wealth of information.

As an undergraduate student at the University of Minnesota, I was struck by the contrast between the validity of the knowledge presented in the science courses that I had taken and the unsupported claims so often made in education courses. The sciences presented a body of knowledge comprising concepts, principles, and theories that explain how and why things in the universe behave as they do. There was almost nothing comparable to this in the courses I took in education. Nevertheless, education is a phenomenon conducted by people and there is no inherent reason why it could not also be guided by a body of concepts, principles, and theories. I devoted a good bit of my time and energies to the goal of developing a science of education. Although I do not present the details of this journey in this book, I do sketch some of the early battles and later successes in the development of my theory of education.

Throughout my public school years and most of my undergraduate years at the University of Minnesota, I found schooling to be reading information in the book, or recording information from lectures to be memorized, then taking objective true–false or multiple-choice tests that required little more than recall of information – and then forgetting almost everything in six weeks! Unfortunately, the latter is essentially what most students are doing in most schools. I was fortunate to have a few school teachers and professors whom I remember fondly as persons who challenged me to think. But now we are beginning to see some colleges and universities applying what we have learned about human learning and problem-solving, encouraging modified instructional programs and alternative evaluation programs. I present some of these new approaches in the last two chapters of this book.

The memorize-test-forget kind of education described in the last paragraph is inherently fraudulent. The consequence of this is that students who experience such education fail to become creative problem-solvers in whatever roles they take as adults. It is probably also one reason why only about 40 percent of young adults accept the responsibility to vote in national elections. With the challenges the peoples of the world face with climate change, we are in a race with time to improve schooling at all levels in all countries. We are almost certain to see massive deaths and property destruction on a scale that makes the Covid-19 pandemic a small incident by comparison. In Chapters 4 and 5, I discuss some of the possible changes we may see in school education in general and in medical education more specifically. With the right leadership,

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I believe it will be possible to achieve the kinds of changes in educational programs that are needed as well as other necessary changes in social institutions. Finding ways to deal with the Covid-19 virus catalyzes some creative innovations in education and in the workplace.

Throughout my career I have been blessed with the love, support, and thoughtful counsel of my wife, Joan. My three children have been a joy to us, and I have learned much from them. I have been fortunate to have had many outstanding students and visiting professors, many of whom continue to advance programs we had initiated together. It was my good fortune to have strong, supportive administrative leadership in all of my positions, and especially at Cornell University.

In 1990, Alberto Cañas joined the institute as Associate Director, and the Florida Institute for Human and Machine Cognition was fully underway. As noted earlier Alberto led a team of workers to develop the outstanding software suite CmapTools that will be described more fully in Chapter 2. The institute expanded its operations and became an independent agency under the title of the Florida Institute for Human and Machine Cognition.

From the 1990s onward, it was my pleasure to work with a number of members of IHMC to solve various problems, as will be described in the chapters of this book. In addition to the strong support and involvement of Kenneth Ford and Alberto Cañas, a number of other colleagues have assisted me in my work and in the preparation of this book. These include Alan Ordway, an able master of computers and computer software, always available to answer a question when problems would arise. Julie Sheppard, Administrative Assistant to Kenneth Ford, has assisted in various tasks including provision of permissions for some of the materials included. Several of the staff members have helped develop materials included in the book including Roger Carp, William Howel, and Robert Hoffman. When Joan and I moved to the Sheraton Senior Living Residence in Lakewood Ranch, Florida, it was my good fortune to obtain the volunteer services of Dee Humphreys in typing the many revisions and the final manuscript for the book. David Tangren has also assisted me in some of the final tasks associated with the completion of the manuscript and the preparation of materials for final submission. To all of these people, I am deeply indebted for their voluntary assistance. Finally, I wish to thank my wife, Joan who has dealt with many hours of isolation as I have worked on the manuscript and required silent study. In so many ways Joan has been for me the wind beneath my wings as well as a loving companion.

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