Most educators agree today that the teaching of critical thinking must be a primary goal for education at any age level and in every discipline. Lenny Shedletsky and Jeff Beaudry have gathered together 19 studies and reports, all of which deal with practices that use some form of graphic representation to facilitate acquisition of critical thinking skills. The scope and variety of the reports presented make this book useful to teachers at all levels of education and in all disciplines.

When I first began the study of education in the early 1950s, North American psychology was overwhelmingly dominated by behavioral psychology, and one must not speculate on the hidden workings of the brain. Only manifest behavior was to be a data source for making inferences about animal or human learning. While this psychology was sufficient for the study of learning of rats, pigeons, and cats, I failed to see any significant value in behavioral psychology for understanding human learning. My first 10 years in the study of education was marked by a frustrating search for a learning theory that could help me become a better educator. While there was Jean Piaget’s work with children’s reasoning in the 1920s and Frederick Bartlett’s cognitive psychology in the 1930s, none of this was taught in the psychology courses I took at the University of Minnesota in the 1950s. However, when I later learned of this work, I still saw this of limited value for understanding how people acquire and use concepts in building understanding of any discipline. It was not until David Ausubel’s *Psychology of Meaningful Verbal Learning* was published in 1963 that my graduate students and I finally found a theory of learning we thought could inform our work. Ausubel’s theory deals with how learners acquire and use new concepts and propositions to think. More recently psychologists and educators have discovered the important work of Lev Vygotsky, done in the 1920s and ’30s, showing the important role that social discourse plays in learning, and hence, the importance for using collaborative groups for new learning.

Ausubel makes the clear and important distinction between *rote learning* and *meaningful learning*. When the learner makes no effort to integrate new concepts and propositions into existing, relevant concepts in their cognitive structure, she/he
is engaged in rote learning. Meaningful learning occurs when the learner actively seeks to relate new concepts and propositions to existing, relevant concepts and propositions into the learner’s cognitive structure. Since learners vary in the degree to which their relevant concepts are developed, and in the amount of effort they make to achieve integration, there is a continuum from very rote learning to highly meaningful learning, not just a simple dichotomy. To achieve a high level of critical thinking in any domain of knowledge, a person must have developed highly differentiated concepts and propositions in that domain through meaningful learning.

In the early 1970s, our research group at Cornell University sought to teach 1st and 2nd grade children important basic concepts of science using audio-tutorial instruction. We had designed a series of science lessons involving a variety of hands-on activities guided by audiotape, 8mm loop films, and various illustrations. The lessons were well liked by the students and their teachers. Interviews with children after instruction showed they had made progress in learning the concepts taught, but it was difficult to show exactly what new ideas they had mastered or partially mastered. Building on Ausubelian theory, we decided to transform interview transcripts into a hierarchical arrangement of the concepts and propositions the students gave our interviewers. Thus was born the knowledge representation tool we call concept map. There are other similar tools, but they lack one or more of the following characteristics: all concepts are connected to other concepts with lines that include “linking words” that form a proposition or a clear statement of the relationship between the two concepts. Mind Maps™, for example, have no linking words and no propositions, and therefore, they cannot show explicit concept meanings. Second, concepts are arranged hierarchically from most general, most inclusive, to least general, most specific, moving from the top of the map to lower sections. This is in accordance with Ausubel’s ideas of learning and cognitive structure formation. In the 1980s, I worked with the Florida Institute for Human and Machine Cognition (IHMC) to develop computer software to make it easy to make our kind of concept maps. This CmapTools software is available to anyone at no cost at: http://cmap.ihmc.us. Thousands of copies of this software are downloaded from IHMC servers every month from virtually all over the world. CmapTools also contain powerful assistance for collaborative learning and for attaching any kind of digital resource to concepts in the map.

In the chapters of this book, you will see a variety of knowledge representation tools utilized, including our form of concept maps. In every case, the goal has been to use these knowledge representation tools to help foster critical thinking. The book should be a rich resource for developing your own methods for teaching and appraising critical thinking. Moreover, helping students to become better critical thinkers also helps them to become better learners of any subject matter domain.
Moreover, students who become better learners also become more creative in applying the knowledge they have learned to new problems and situations. This is the goal every educator should seek to achieve.

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