Part 1
Research on Learning
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INTRODUCTION TO RESEARCH ON LEARNING

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The psychology of subject matter is the scientific study of how people learn school subjects such as reading (Huey, 1908/1968), writing (Kellogg, 1994; National Research Council, 2012), and mathematics (Kilpatrick, Swafford, & Findell, 2002; Thorndike, 1922). Although research on learning in academic content areas has a long history dating back to classic research by Huey (1908) and Thorndike (1922), much progress has been made, particularly in the past 25 years. For this reason, the development of the psychology of subject matter has been recognized as one of the major accomplishments of educational psychology (Alexander, Murphy, & Greene, 2012; Mayer, 1999, 2004, 2011; Shulman & Quinlan, 1996). This first section of the Handbook provides a research-based overview of the exciting progress being made in our understanding of learning in subject areas. In addition to chapters on reading, writing, and mathematics, we have expanded the section to include the subject areas of science, history, second language learning, and physical education, as well as the hidden curriculum areas of critical thinking, study strategies, metacognition, and motivation.

In “Learning to Read” (Chapter 2), Emily Fox and Patricia Alexander provide a lifespan approach to what is widely recognized as the most central of all academic skills, reading, which they define as “the complex communicative behavior of deriving meaning from presented text” (p. 8) Building on foundational scholarship by Gray (1951), the authors describe six important themes in research on learning to read: recognizing the changed role of reading, developing a broad concept of reading, accepting the idea that growth in reading is a continuous process, broadening the reading program in harmony with expanding interests and needs of pupils, recognizing that guidance in reading is essential in each curriculum field, and adjusting reading programs to the unique characteristics and needs of pupils. They update their earlier chapter by focusing on research conducted during the past 10 years. The authors broaden our understanding of how people learn to read by examining how reading develops over one’s lifespan.

In “Learning to Write” (Chapter 3), Susan De La Paz and Deborah McCutchen focus on three cognitive processes in writing as first articulated by Hayes and Flower (1980; Flower & Hayes, 1980): planning, translating (or text production), and reviewing. In
addition to updating research, the authors review intervention programs that have been successful in promoting each of these processes in writing, and thereby improving students’ written products. The authors recommend that future research examine writing specific to each discipline, rather than writing in general, and examine how to improve writing for argumentation.

In “Learning Mathematics” (Chapter 4), Ann Edwards, Indigo Esmonde, Joseph Wagner, and Rachel Beattie begin with a case study of a sixth-grade student’s mathematical thinking, and seek to show the value of studying mathematical activity in situ. The authors describe how the field has been influenced by behaviorist, cognitive, and situated theoretical frameworks. They review current research on the organization and processes of mathematical cognition, the role of discourse and language on mathematics learning, identity in mathematics learning, psycho-social aspects of mathematics learning, and the cognitive neuroscience of mathematics learning. Challenges in future research include taking into account the complexity of the context of mathematical thinking, creating effective multidisciplinary collaborations, and bridging across different theoretical approaches.

In “Learning Science” (Chapter 5), Richard Duschl and Richard Hamilton provide a vision of the progress that has been made in the field of science education over the past several decades. Some key research topics include the knowledge and skills that young students bring to school, adaptation of instruction to foster learning progressions, epistemic practices and cognition, and the debate on whether science learning is domain-general or domain-specific. The chapter begins by examining research concerning the appropriate level of guidance in science instruction, how researchers can close the gap between research and practice in science education, and the role of learning analytics. Building on dozens of recent reports on science learning, they show that with appropriate evidence-based supports and sequencing, children are capable of complex scientific reasoning.

In “Learning History” (Chapter 6), Linda Levstik notes that empirical research on how students learn history is a relatively new field, which started to take hold in the 1980s. She describes a theoretical shift from reflective inquiry—understanding history in terms of current problems—to sociocultural theories—in which people’s understanding of history is influenced by the social and cultural context. Much of the research is based on naturalistic/descriptive studies, although more recently quantitative studies have been added to the methodological mix. The chapter reviews research on national narratives, narratives of global interaction, role of gender in history learning, and role of tools for historical inquiry. The author calls for future research on emergent historical thinking, sense-making in the context of world history, and transfer.

In “Learning a Second Language” (Chapter 7), Min Wang makes a compelling case for the importance of second language learning in schools to prepare students for the global economy and to address the needs of immigrants. She describes three major constituents in learning words in a second language: phonology, the sounds of the language; orthography, the writing system for putting words into print; and morphology, meaningful word parts (e.g., suffixes, prefixes, a change to plural or past tense, or compound words). She outlines major theories of cross-language transfer concerning how knowledge about phonology, orthography, and morphology in one language affects learning a second language. The chapter closes with a call for more focused research on the causal mechanisms underlying cross-language transfer in learning a second language, the role of learner’s first language proficiency, measurement of language proficiency, and the influence of the second language on the first language.
In “Learning Motor Skill in Physical Education” (Chapter 8), Catherine Ennis and Ang Chen examine how to help people improve their motor skills in physical education. The authors show how research on motor skill learning began in the 1930s, and since the 1970s has been influenced by information-processing theories, expert-novice comparison theories, and dynamical systems theories. More recently, the field has expanded to include training in decision-making in physical games. The authors show the benefits of taking an evidence-based approach to promoting skill learning in physical education, and point to the need for future research on motor skill learning in complex sports environments.

In “Learning to Think Critically” (Chapter 9), Christina Bonney and Robert Sternberg examine the important, but sometimes unstated, curricular objective of helping students become critical thinkers. Recent educational frameworks such as the Common Core Standards (Porter, McMaken, Hwang, & Yang, 2010) highlight critical thinking as a key skill for success in the 21st century. The authors summarize core concepts concerning developmental considerations, motivational considerations, the role of the student, the role of the teacher, and the role of context. They also summarize foundational research on teaching and learning of critical thinking skills, including Lipman’s (2003) Philosophy for Children, Feuerstein et al.’s (1980) Instrumental Enrichment, Bransford et al.’s (1988) anchored instruction, and Sternberg et al.’s (2008) successful intelligence. The authors call for future research on the role of a collection of thinking skills, including critical, analytic, practical, creative, and wisdom skills.

In “Learning to Study Strategically” (Chapter 10), Daniel Dinsmore, Emily Peterson, and Denis Dumas examine current research on how students can learn study strategies that improve their learning. The chapter begins with a historical overview of Marton and Saljo’s (1976) examination of qualitative differences in learning, Veenman’s (see Chapter 11) analysis of styles of learning, Alexander’s (1997) model of domain learning, and Winne and Hadwin’s (1998) conceptualization of study tactics. The authors review research on the role of intra-individual development of study strategies, the interaction among study strategies, and the conditions that influence study strategy use. Then, they offer evidence-based recommendations for incorporating academic study strategies.

In “Learning to Self-Monitor and Self-Regulate” (Chapter 11), Marcel Veenman focuses on students’ learning of metacognitive knowledge and skills for academic learning, including self-monitoring and self-regulating. In short, this chapter examines learning how to learn. Veenman provides an historical overview of research on key concepts, including metacognitive knowledge, metacognitive skills, and development of metacognitive skills. Some current research topics include assessment of metacognitive skills and instruction in metacognitive skills. The author calls for research that goes beyond narrow, short-term studies of metacognitive instruction, and suggests that cognitive neuroscience research is also a valuable methodology for understanding metacognitive processing during learning.

In “Learning with Motivation” (Chapter 12), Hadley Solomon and Eric Anderman show how motivation is a pervasive and fundamental issue in academic learning that has blossomed as a research area in the last 40 years. The chapter begins with Pintrich and Schunk’s (2002, p. 5) classic definition of motivation as “the process by which goal-directed activity is instigated and sustained.” The study of motivation has shifted from behavioral theories based on drive reduction, which were popular prior to the 1970s, to social cognitive theories, which have generated a substantial research relevant to academic motivation since the 1970s. The chapter reviews some of the most influential
theories of academic motivation: social cognitive theory, such as motivation based on self-efficacy; achievement goal theory, which focuses on the learner’s academic goals; self-determination theory, which includes the distinction between intrinsic and extrinsic motivation; expectancy-value theory, which consider how the learner values various academic experiences, and control-value theory, which includes emotions in academic achievement. The authors establish how research on motivation has implications for student testing, design of learning tasks, grouping of students for instruction, and how to provide feedback. Concerning future directions for motivation research, they point to the need for research on motivation-based interventions as well as developmental and qualitative studies of motivation.

Overall, the first section of the Handbook helps you understand the advances being made in the scientific study of learning in subject areas. Whether dealing with traditional academic domains (e.g., reading or mathematics) or with dimensions of the hidden curriculum (e.g., critical thinking or learning to learn), the contributing authors have effectively followed in the footsteps of such forbearers as Huey and Thorndike—further advancing the discipline of educational psychology and supporting those who benefit from the knowledge educational psychology affords.

REFERENCES


