



# Historical Review of Learning Strategies Research: Strategies for the Whole Learner—A Tribute to Claire Ellen Weinstein and Early Researchers of This Topic

Barbara L. McCombs\*

University of Denver, Denver, Colorado, CO, USA

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### \*Correspondence:

Barbara L. McCombs  
bmccombs@du.edu

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This selective historical review summarizes research on learning strategies conducted in the past 50 years and summarizes how the field has evolved. Two goals guide the review: (1) update the literature on the origins of the learning strategies research “movement” and (2) highlight in the supplement the work of one of the early contributors, Claire Ellen Weinstein, whose pioneering work endures up to now. This review fills the gap of other recent reviews by including research on learning strategies began in the 1960s and 1970s that received significant funding from military sources but remained largely hidden in technical reports and hard to find academic documents. The outcomes of this review reveal that the field is thriving, with two major unifying themes. First, there is a focus on metacognition and second, there is a focus on the whole learner and interventions that address cognitive, metacognitive, affective, physical, cultural, and social needs. The research of Dr. Weinstein (who passed June 23, 2016) has framed past and current learning strategies research agendas and includes her development, validation, and implementation of the Learning and Study Strategies Inventory in traditional and online learning contexts. This review and Supplementary Material section’s personal stories include many of the early learning strategies research findings, definitions, and interventions that remain in use across the nation and world today. Future research issues and areas needing more focused attention in the years ahead given our increasing complex, digital, and diverse world are summarized in final sections of this review.

**Keywords:** learning strategies, self-regulated learning, motivational skills training, social support, social and affective neuroscience

What is LEARNING STRATEGY? *A strategy used primarily during the process of learning such as forming a mental image of a process.* (Pam, 2016, p. 1, Psychology Dictionary, <http://psychologydictionary.org/learning-strategy/>.)

My purpose in this review is to update the literature on the origins of the learning strategies research “movement.” Reviews over the past 50 years have missed many of the research contributions up to now of those who were part of the military-funded efforts during the late 1960s and early 1970s to enhance training effectiveness and efficiency in traditional and computer-assisted training contexts. Much of this early research ended up in technical reports and products not easily accessible in

academic databases such as ERIC. This review is meant to update the field of learning strategies research and show how it has evolved into the many specialties we see today.

A secondary purpose is to highlight, in the Supplementary Material, the work of one of these early contributors, Dr. Claire Ellen Weinstein, whose personal and professional friendship endured through our graduate student years until she passed suddenly on June 23, 2016. Readers are asked to understand that the dedicated homage in the Supplementary Material section to Dr. Weinstein is selective given it is a product of my own recollections and potential biases.

On the whole, my hope is that it will inspire current and upcoming researchers interested in helping all students succeed as they search for theoretically and empirically grounded educational paradigms that address how students learn needed skills and characteristics in twenty-first century contexts. Therein, Weinstein may be appreciated as a role model for reaching new frontiers in education sciences.

## HISTORICAL BACKGROUND OF LEARNING STRATEGIES AS A RESEARCH AREA

It is nearly impossible to be right in tracing where the term “learning strategies” actually originated given the flurry of studies in the last century focused on moving from behaviorism to cognitive theories of learning (cf. Piaget, 1926; Ryle, 1949; Cronbach, 1951, 1957, 1975; Cronbach and Meehl, 1955; Bloom, 1956; Inhelder and Piaget, 1958; Rogers, 1961; Flavell, 1963, 1971, 1976; McLuhan, 1967; Newell and Simon, 1972). Some researchers (e.g., Vygotsky, 1962, 1978; Zimmerman and Schunk, 2001, 2003) trace the origins to Dewey (1910) or Thorndike (1912) but what I know from my own experience in the late 1960s is that the term “learning strategies” was derived from research on “study skills and memory strategies” (e.g., Hare, 1963; Atkinson and Shiffrin, 1968; Hagen and Kingsley, 1968; Belmont and Butterfield, 1969; Corsini, 1971; Wittrock, 1974a,b). It also derived from new cognitive theories such as Ausubel’s (Ausubel, 1960, 1963, 1968; Ausubel and Fitzgerald, 1962; Ausubel and Youssef, 1963) research on the value of advanced organizers for student learning—reactions in large part to Skinner’s (Skinner, 1953) behaviorism. It is within this context that my graduate research training and team of professors and fellow graduate students at Florida State University’s (FSU) Computer-Assisted Instruction (CAI) Center were encouraged to pursue dissertation topics of high interest to military training (e.g., Leherissey, 1971; Leherissey et al., 1971).

A few researchers working in various military research organizations preferred to refer to “learning strategies” that could support student success in self-paced and/or computer-based military training environments (e.g., McCombs et al., 1973b; Judd et al., 1979). As a graduate student at FSU’s CAI Center from 1969 through late 1971, I joined the team in conducting military research on the effects of various forms of computer-managed instructional (CMI) and CAI systems. The era was marked with excitement and healthy competition within our own and other universities studying strategies for computer-based

learning. Joining as new researchers, Claire Ellen Weinstein at the University of Texas in Austin and I were the only two female graduate students in a group of about 40 noted researchers and research center directors with military funding to do learning strategies research (Leherissey, 1971; Leherissey et al., 1971; O’Neil et al., 1972; McCombs et al., 1973a, 1977, 1986a,b; Weinstein, 1978; McKeachie, 1986, 1988, 1990; Weinstein and Mayer, 1986; Weinstein et al., 2000).

Throughout this early period of learning strategies research, different areas of interest emerged and solidified over time. There continued to be those who focused on the area of reading comprehension strategies. Zhang’s (Zhang, 1993) literature review highlighted much of this research, including that of Carroll (1977), Anderson (1977), Don Dansereau (Holley et al., 1979), and others working to improve students’ reading comprehension and memory (e.g., Smith, 1967; Beck et al., 1982; Blanton and Wood, 1984; Afflerbach, 1990; Bell, 1991). Researchers were then recommending four categories of reading strategies: *cognitive strategies*, *compensation strategies*, *memory strategies*, and *test-taking strategies* (Paivio, 1986; Zhang, 1993).

Other significant research was being published by learning strategies researcher, Wittrock (1978, 1986a,b, 1989a,b, 1990, 1991, 1992) and Wittrock and Alesandrini (1990). Wittrock (1974a,b) assumed that learners link new with old ideas to gain a better conceptual understanding, but his major contribution was to acknowledge (a) metacognition as a higher order process learners could demonstrate, (b) motivational processes that impact memory processes and information processing, (c) neurological brain functions involved in learning, and (d) constructivism as a better way of understanding learning than prior cognitive views. Wittrock (1978, 1980, 1992) was also a visionary in recognizing the links between neurophysiology and cognition. As interest surged in the brain sciences in the 1970s and 1980s, Botkin (1980) reported research connecting brain research to issues in education such as creativity, imagination, learning disabilities, gender differences in brain functioning, and art education. What this research revealed was that students could be taught strategies for enhancing their methods of processing information, solving problems, and comprehending or remembering what they were learning. As this research evolved, educators, policymakers, and researchers began to envision a newly emerging concept of holistic education (Bull and Wittrock, 1973; Wittrock, 1981, 1986a,b; Wittrock and Alesandrini, 1990).

Applying Wittrock’s generative learning theory in military training inspired many of us doing early learning strategies research to explore new paradigms for schools and training settings. We were a fairly tight-knit group of researchers who organized conferences, symposia at national conferences, and who shared our research findings on personal and professional levels. Funding agency representatives from civilian and military organizations were present, and lively debates were part of the agenda. Given that many current researchers may be unaware of this early research, it is important to highlight Wittrock’s (Wittrock, 1989a,b) applications of cognitive psychology concepts to the analysis of military language in decision-making. His research led to other military research examining the role of background knowledge in military communication, the effects

of context on meaning, the relevance of syntactic and semantic analysis for military language use, and the usefulness of inferential and domain-specific processing.

Similarly, Bob Seidel (associated with early military research related to learning strategies and new computer-based systems for education and training) foresaw the kinds of learning models and contexts that would better serve the needs of students and their instructors (Seidel, 1969, 1971, 1973; Seidel et al., 2005). Others influential in the research community in these early days were Sigmund Tobias, Thomas Duffy, and Dexter Fletcher—all of whom contributed to our understanding of the role of prior knowledge and a host of other learner, context, and system variables to learner performance (e.g., Tobias and Duffy, 2009; Tobias, 2016; Tobias et al., 2016).

## EARLY FINDINGS AND RESEARCH DIRECTIONS

New research questions were posed, presentations of current research projects were given ample time for discussion, and side meetings to identify new research projects were held with interested funding agencies that included the Office of Naval Research, Army Research Institute, National Science Foundation, Naval Personnel Research and Development Center, US Department of Education, Human Resources Research Organization, Defense Advanced Research Projects Agency, and University of Pittsburgh's Learning Research & Development Center (cf. Glaser, 1963; Atkinson, 1968; Atkinson and Shiffrin, 1968; Seidel, 1969, 1971; Newell and Simon, 1972; Suppes, 1972, 1973, 1974, 2002; Wesche, 1975; Collins, 1978; Dansereau, 1978; Chipman et al., 1985; McKeachie et al., 1985; McKeachie, 1986, 1988, 1990; Sternberg, 1997; Tobias, 2016; Tobias et al., 2016). Government, military, and industry agencies research began research programs that have continued in various forms until now. The following summarizes these early efforts and leaders in the field.

### The Use of Technology for Individualized and Self-Directed Learning

Constructivism was the dominant learning theory of the 1960s and 1970s and led the way for new uses of technology in military and non-military settings. A recent online paper by Allsop (2016) describes how early work by Piaget and others began to influence those leading learning strategies research projects. Missing in this account, however, was research by those of us involved in initial military research projects. This was because much of this research ended up in technical reports and only a few academic journals. It was not until the 1980s and 1990s that much of this work came into the spotlight (O'Neil et al., 1972; McCombs et al., 1973a,b; Paris and Lindauer, 1976; Paris et al., 1977; Judd et al., 1979; McCombs, 1982a,b, 1986a,b,c, 1988; McCombs and Marzano, 1989, 1990; Weinstein and McCombs, 1998; Paris and Paris, 2001).

Most of the studies done during the late 1970s and early 1980s on using technology to individualize learning revolved around how strategy training could enhance problem solving and comprehension of the material while reading in various

content areas (Lefcourt, 1976; Brown et al., 1983a,b; Chipman et al., 1985; Bransford et al., 2000). Important findings during this time led to the conclusion that learning strategies could be incorporated within an information processing model that also looked at how metacognitive, cognitive, and social affective strategies could assist students in acquiring higher levels of second language learning (cf. O'Malley et al., 1985; Chamot et al., 2004). For example, Slavin (1980) combined cooperative learning with reading comprehension strategies and demonstrated enhanced performance for students receiving both types of training.

Others were also exploring such combinations, notably Dansereau et al. (1983) and others using an affective component (Rubin, 1975, 1981; Naiman et al., 1978; Rubin and Thompson, 1982). At the same time, Brown and Palincsar (1982) recognized that ideal training packages would consist of practice in the use of task-appropriate strategies, instruction concerning the significance of those activities, and instruction concerning the monitoring and control of strategy use. These researchers separated cognitive strategies (those more concerned with individual tasks and requiring the material to be manipulated or transformed to enhance understanding) from the metacognitive strategies (concerned with the planning for the learning, monitoring of understanding, and evaluation of one's own learning) to maximize students' learning potential (Brown et al., 1983a,b).

### Influences from Developmental Psychologists in the Early Years

Of the many constructs that emerged during the 1970s, metacognition as described by Livingston (1997) was a large part of the cognitive theory revolution. The origin of the term is credited to Flavell (1979) and later in 1987 distinguished between metacognitive knowledge and metacognitive experiences or regulation. The metacognitive knowledge component was defined as acquired knowledge about cognitive processes that can be used to control cognitive processes. Metacognitive knowledge was further divided by Flavell (1976) into three categories: knowledge of person variables, task variables, and strategy variables. Earlier Flavell (1971) had used the term *metamemory* to refer to an individual's ability to manage and monitor the input, storage, search, and retrieval of the contents of his or her own memory. The academic community was invited to engage in additional metamemory research, and this theme of metacognitive research continued more than 30 years later. Flavell (1963, 1971) also implied that metacognition is intentional, conscious, foresighted, purposeful, and directed at accomplishing a goal or outcome. In subsequent research, these implications have been carefully scrutinized; and Kentridge et al. (2004) argued that metacognitive processes needed not to operate in a person's conscious awareness.

Flavell (1976) recognized that metacognition consisted of both monitoring and regulation aspects. In the context of information storage and retrieval, Flavell (1976) defined three "metas" that children gradually acquire: (a) to identify situations in which intentional, conscious storage of certain information may be useful at some time in the future; (b) to keep current any information that may be related to active problem-solving and have it ready to retrieve as needed; and (c) to make deliberate systematic searches

for information that may be helpful in solving a problem, even when the need for it has not been foreseen. Later Flavell (1981, 1987, 2004) proposed that the emergence of awareness of the flow of time—awareness of a future time—could support the ability to form metacognitive goals. Most importantly for the field of learning strategies research, he emphasized the sense of the self as an active agent in one's own experiences emerged during childhood development. He also began in 1987 to actively encourage the development of children's metacognition given that school settings provide many opportunities for students to develop metacognitive knowledge about persons, tasks, and strategies. His visionary research paved a big path in the learning strategies research agenda.

## Connecting Cognitive and Metacognitive Strategies in the 1980s and 1990s

In connecting work in the area of cognitive and metacognitive strategies, Livingston (1997) points out that both are needed for learning success. What cognitive strategies include is testing oneself for understanding of a text to see if learning goals have been achieved. Metacognitive strategies come into play as experiences before or after a cognitive activity when the learner recognizes that he or she has failed to understand something they have read or listened to and then choosing to rectify the situation by thinking about their own thinking and learning processes and what can be changed to achieve learning goals. Livingston states the following as how these strategies work together (p. 1):

Metacognitive and cognitive strategies may overlap in that the same strategy, such as questioning, could be regarded as either a cognitive or a metacognitive strategy depending on what the purpose for using that strategy may be. For example, you may use a self-questioning strategy while reading as a means of obtaining knowledge (cognitive), or as a way of monitoring what you have read (metacognitive). Because cognitive and metacognitive strategies are closely intertwined and dependent upon each other, any attempt to examine one without acknowledging the other would not provide an adequate picture.

The field advanced at that point by defining knowledge as metacognitive when actively used in a strategic manner to ensure that a goal is met—by providing direct instruction in learning strategies so that teachers can help improve the self-confidence and achievement of their students especially the educationally disadvantaged (cf. Weinstein, 1978). A metacognitive strategy would then consider a person variable, a task variable, and a strategy variable. The following example describes a student who uses his or her knowledge in planning how to approach a math exam: "I know that I (person variable) have difficulty with word problems (task variable), so I will answer the computational problems first and save the word problems for last (strategy variable)." As Livingston (1997) explains, simply knowing one's cognitive strengths or weaknesses and the nature of the task without

actively using this information to regulate, monitor, or oversee learning is not metacognitive.

## THE 1980s AND 1990s DEBATE: DO LEARNING STRATEGIES ENHANCE SKILL AND WILL TO LEARN ACROSS DEVELOPMENTAL STAGES AND CONTENT AREAS?

Further elaborations of the learning strategies that proved most effective for a variety of learners were provided by Borkowski et al. (1987), Brown (1978, 1990), Entwistle and Hounsell (1975), Pressley and Harris (1990), and Carr et al. (1989). Most of the studies focused on learning strategies while reading, with some emphasis on motivation and metacognitive strategies for enhancing comprehension of what was read (Palincsar, 1986; Palincsar and Brown, 1986; Brown, 1992). Scott Paris, however, refocused attention on differences between reading comprehension skills and the will to read (cf. Paris and Lindauer, 1976; Paris et al., 1977, 1983, 1984, 1986; Paris and Cross, 1983; Paris, 1998). Early collaborations began between me and Barbara Lindauer who worked for/with me at McDonnell Douglas and the University of Denver and these soon led to collaborations with Scott Paris and Claire Ellen Weinstein around the need for learning strategies that combined will, skill, and strategic thinking (e.g., Weinstein, 1978, McCombs, 1982a, 1986a,b, 1988, 1989; McCombs and Marzano, 1989, 1990; Zimmerman, 1989, 1990, 2000, 2001; Paris et al., 1991; Weinstein and McCombs, 1998).

## Looking at the Skill Component

Most researchers in the early years looked for general classes of learning strategies that could enhance learning in training and educational settings. A stimulus for much of the early military research on learning strategies was Don Norman (Norman, 1969, 1976, 1977; Lindsay and Norman, 1972, 1977). What Norman (1969) began to identify was the need for students to think about their own mental processes, their short-term memory limitations, and how they could "chunk" related concepts to improve their memory short-term. He was among the first to find that learning strategies could be generalized across diverse content areas for young children through adults. More importantly, Norman (Norman and Rumelhart, 1975; Norman, 1977) identified holistic learning strategies that college students could be taught to improve their academic success.

Some learning strategies researchers were concerned more specifically with memory and reading comprehension (e.g., Rothkopf, 1970; Anderson and Biddle, 1975; Paris and Lindauer, 1976; Pressley, 1976, 1977; Paris et al., 1977, 1983, 1986; Brown, 1978, 1990, 1992; Palincsar and Brown, 1986; Nolan, 1991). Bloom (1980, 1985) later built on some of these ideas in creating his own taxonomy of learning strategies and approaches for children of different ages and stages of development. Others applied cognitive psychology to helping students learn strategies for remembering, learning, and understanding (cf. Bransford and Heldmeyer, 1983).

## Looking at the Will Component

Weinstein and McCombs (1998) and McCombs and Marzano (1989, 1990) put forth a conceptual framework that defined the will component as including (a) affective and motivational strategies and (b) cognitive and metacognitive strategies identified through research to be part of the learner's tool kit for success across content areas. At the same time, the specific strategies needed for success in domain-specific areas such as reading and mathematics were described by Weinstein (1978), Derry (1990), Paris (1991), Paris and Winograd (1990), and Zimmerman (1989).

The practical application of this integration of learning strategies interventions was on my research agenda during these years and resulted in a book series for the American Psychological Association (APA Books) entitled *Psychology in the Classroom*. More than 14 books were commissioned by editors Dr. Sharon McNeely and myself over nearly 10 years as a project for APA's Division 15, Educational Psychology (McCombs and McNeely, 1994). We each worked with an elementary, middle, and high school practicing teacher with the objective to produce practical guidelines and strategies for classroom implementation. For example, one booklet with a middle school mathematics teacher was published on the topic of "motivating hard to reach students" (McCombs and Pope, 1994) another with a high school English teacher on the topic of "stimulating self-regulated learning" (Ridley, 1991; Ridley et al., 1994). The series continues to be relevant today and is sold to teachers across the US and world.

More recently the APA's Education Division invited a group of experts on topics facing teachers for which they needed professional development training. We met initially in 2004 and worked collaboratively to develop a series of online modules for teacher certification through 2011, after which time our online modules were programmed for teacher use. My module (McCombs, 2012) on Developing Responsible and Autonomous Learners: A Key to Motivating Students can be accessed at <http://www.apa.org/education/k12/learners.aspx>. This module takes into consideration the holistic nature of individual student learning and the most effective practices for helping them develop into autonomous and responsible learners. Addressing the whole learner in developmentally appropriate ways includes establishing positive student relationships and listening to each learner's voice in creating productive learning climates.

## FURTHER UPDATES OF LEARNING STRATEGIES RESEARCH REVIEWS

In addition to the research reported above, there have been only a few major learning strategies research reviews that update the field from 2009 through the present. Findings from these reviews are briefly summarized, twenty-first century research leaders are identified, and research themes are identified. Highlights from pioneer researcher and innovator, Claire Ellen Weinstein, are presented. The section ends with a view of how the field has evolved to the present.

## Reviews of Learning Strategies Research from the 1970s through 1990

One of the last major reviews of research in the learning strategies area was done by Nambiar (2009). The focus of this review was to capture what had been the origins of the learning strategies research area as well as significant findings. This was an important paper for those who were just beginning to explore various content-specific and more general strategies for helping students learn more effectively from early school years into adulthood. In his review, the origins were traced to the field of cognitive psychology from 1970 to 1990, after which the research on learning strategies became more diverse and more revealing in its findings. He acknowledged among the earliest contributors Dansereau (1978), Rigney (1978), Wesche (1975), and Weinstein (1978).

What Nambiar (2009) does not report is that during this same time period, Weinstein and colleagues (Weinstein et al., 1987; Weinstein and Palmer, 1990) were validating her Learning and Study Strategies Inventory (LASSI). The LASSI has been revalidated and revised several times since and has been used in international studies with college students, recently by Magno (2010, 2011) with 755 college students from different university in the Philippines. It was Weinstein and Mayer (1986) who believed that information processing could help us understand the role of learning strategies in the learning process in a four-stage encoding process involving selection, acquisition, construction, and integration. They suggested that the process of selection and acquisition focuses on the gathering of knowledge while construction and integration focuses on what knowledge is acquired and how it is organized.

Also missing were Weinstein and Mayer's (Weinstein and Mayer, 1986) findings that learning strategies are used intentionally by learners to facilitate their learning, suggesting that learning strategies affect learners' motivational or affective state—the way a learner selects, acquires, organizes, or integrates new knowledge. This was a major step forward for the field, and helped researchers focus on the role of metacognitive, motivational, and affective processes in enhancing student learning. In my own research, these findings had also emerged and were defining what we now refer to as "learner-centered" approaches addressing whole learners across major domains that also included the social and emotional needs of learners at different developmental stages (cf. McCombs, 1986a, 1988, 1989; McCombs and Marzano, 1989, 1990; McCombs and Whisler, 1989).

## Other Learning Strategies Research Reviews

Strategic learning was found by Ertmer and Newby (1996) to be a characteristic of expert learning wherein learners can clearly realize their individual advantages and disadvantages regarding all aspects of strategies to enable them to better manage their learning. However, in online learning environments, it is often more time and effort consuming for students to decompose a task into a sequence of subtasks in order to plan and manage their own online learning. In addition, choosing meaningful information from the Internet and integrating it into learning domains can present another challenge for all online learners.

Online environments also challenged students in learning to learn skills such as articulation and reflection, planning skills, study skills, finding and applying relevant examples, and self-evaluation. The technological aspects of Internet-based learning environments were unfamiliar to particularly disadvantaged or developmentally challenged students. As a result, modifying the construct of strategic learning of Weinstein (1978) and Weinstein and McCombs (1998) became necessary and provided an impetus for the latest version of the LASSI (Weinstein et al., 2016) described in a later section.

Additional reviews were reported by Oxford (1990, 1996), with the suggestion that there is a *system of strategies* that support each other in categories of direct and indirect learning strategies. In this system, direct strategies include memory, cognitive, and compensation strategies while indirect strategies include social, affective, and metacognitive strategies. In all, there are further divisions in 19 sets of strategies that cover 62 behaviors that help explain how learners learn. Nambiar (2009) pointed out that this is problematic because (a) many of the behaviors are overlapping and make it difficult to identify which strategies and behaviors are most important to learning and (b) the behaviors cannot be attributed to any particular theory of learning. Nonetheless, Oxford (2001) reported that the system provided the foundation for the Strategy Inventory for Language Learning used in major studies around the world.

## Using Learning Strategies Research in 1980s and 1990s Classroom Interventions

In more applied research reviews, Seifert (1993) described how learning strategies can be used in the classroom. He acknowledged that much research had been conducted on domain-specific problem solving and other learning strategies but focused his discussion on *generalizable strategies that were well-researched* and had been demonstrated to enhance memory while also generalizing across content domains and a wide age range from grade three through university undergraduates. These studies altered student behavior using direct instruction, self-instruction, and reciprocal instruction. Maximum learning gains were realized when students spontaneously engaged in appropriate strategy use, leading Seifert (1993) to suggest that teachers not only need to teach students various strategies for enhancing learning but also need to explain to students why and when these strategies are most effective.

Much of the work done in the 1980s in learning strategy research was in helping to *identify good learning strategies and ultimately compile a list of such strategies*. Cohen (1998) argued that a close look at the parallels between the work done in cognitive psychology and learning strategies shows that some of the work done with learning strategies in the area of language learning also has some theoretical base in cognitive theory. Cohen (1998) concludes despite research in the early 1980s, the vast research conducted on identifying strategies and compiling lists of characteristics of good language learners found a need to examine any similarities or differences in these characteristics in the non-English-speaking world.

Finally, a big movement through the 1980s was research on *social and emotional intelligence*. As reported recently by one of the early leaders in this field, Goleman (2016) laid out steps for enhancing emotional intelligence (e.g., asking students if they were motivated to put in the time and effort and really cared, getting very honest feedback from trusted people about their strengths and opportunities for growth using a 360-degree systematic assessment instrument, developing a learning plan to begin practicing competencies such as controlling negative emotions, and finding naturally occurring opportunities to practice skills until they become the preferred neurological pathway in your brain). These skills comprised a more comprehensive definition of metacognition that included knowledge of one's own cognitive and affective processes and ability to consciously monitor and regulate those processes.

Researching how well programs for teaching these general skills work has shown highly successful results even as much as 7 years later according to Harvard researchers who tracked people longitudinally and found the skills retained their strength as reported by others with whom they now work (Weissberg and Greenberg, 1998; Zins et al., 2000, 2004; Goleman et al., 2002; Boyatzis, 2008; Goleman, 2016). We see in the next section that indeed newer research continues these successful results.

## Trends in Learning Strategies Research from 2009 through the Present

In recent years, several trends are worth noting in both theoretical and empirical or applied research. From my vantage point, one of the most important trends is *formulating a strong theoretical foundation based on a whole person approach to basic and applied learning strategies research*. In my own research, it has been essential to define the perspective of the self in learning to learn more effectively in a lifespan that covers preschool through adult years (cf. McCombs, 1986a, 1988, 1989, 1991a,b,c, 2001, 2008, 2013a,b, 2014; McCombs and Marzano, 1989, 1990; McCombs and Whisler, 1989). Much of my research has focused on the motivational, affective, and relational strategies that students can employ to help generate the will to learn when they feel or believe they have lost their love of learning in schools. This trend is also revealed in research selectively reported here since the mid-2000s.

## Constructivism and Social Constructivism as Major Theories Grounding Learning Strategies Research

Throughout the 1990s, constructivism and social constructivism were conceptual frameworks guiding and shaping new instructional approaches that emphasized the social and cultural context of cognition (Duffy and Cunningham, 1996). For Jonassen (1991, 2001), social interaction was crucial in the learning process and should lead to collaboration. He advocated this specific approach to learning and instruction in designing computer-based learning environments. For others (Weinstein and Mayer, 1986; Zimmerman and Martinez-Pons 1986, 1988, 1990; Pintrich, 1989), students' motivational orientations and learning strategies were said to help students regulate their cognition and effort, and when combined with critical thinking,

helped learners analyze, synthesize, understand, and remember information. Ames (1992), Pintrich (1989), and Pintrich et al. (1993) suggested that the learning context is critical to fostering motivation and cognitive engagement, along with active learner participation and responsibility, which fosters a motivational orientation toward deep-level cognitive processing, persistence, and effort and significantly effects students' motivational beliefs.

Within the social constructivist learning theory, Driscoll (2002) also suggested that learning is enhanced when students are actively involved in the learning and when critical thinking is promoted through applied and reflective activities. Collaborative problem-based learning was recommended to help students develop skills such as teamwork, collaboration, and cooperation along with critical thinking through the analysis, synthesis, evaluation, and reflection while solving authentic problems in interactive and cooperative forms of learning, which encourage students to develop team skills, such as peer interaction and help. Driscoll (2002) suggested that students' perceptions of online collaborative learning be assessed about group discussions, critical thinking and problem solving activities, peer learning, and help provided. Others have recently added that students should assess their preferences regarding an "ideal" learning environment (Nauert, 2016; Rubin, 2016), laying the groundwork for learner-centered principles and practices.

## Addressing Social, Emotional, and Motivational Strategies for Learning

Anderman (2010) undertook the task of reviewing research supporting not only the important roles of cognition, prior knowledge, transfer, and generation in human learning but also how Wittrock's (Wittrock, 1974b) Generative Model of Learning relates to the social, emotional, and cognitive aspects of academic motivation. Anderman contended that Wittrock's model may have led educational psychologists to seriously consider motivation variables and affective issues that had largely been ignored prior to the 1970s. In particular, Anderman (2010) described how motivation theories drastically changed after the mid-1970s with an emphasis on social-cognitive theories of motivation. Added to these was the importance of prior knowledge as reflected in Eccles and Wigfield's expectancy-value theory (Wigfield and Eccles, 1992, 2002) and Bandura's notion of self-efficacy in his social cognitive theory (Bandura, 1986, 1993, 1997), which acknowledged that motivation to engage in future behavior is intricately tied to prior knowledge and experiences in particular domains. In addition, Wittrock's (Wittrock, 1974b) model suggested a paradigm shift in the study of learning with attention being paid to the role of the learner's mind in creating meaning out of novel situations and the role of the self in the field of motivation.

In a tribute summarizing Wittrock's contributions to educational psychology, Tobias (2010) characterized Wittrock's generative learning theory as "remarkably prescient" in setting the stage for the later paradigm shift from cognitive to constructivist approaches to instruction, including constructivist learning strategies. Other researchers studying motivation from different theoretical orientations focused on linking student motivation and self-regulated learning strategies at the college level

(e.g., Pintrich and Zusho, 2002). Pintrich and Zusho (2002) addressed the persistent problem of college student motivation at all levels of the postsecondary system, including that students do not seem to care about their work, seem more interested in the course content, only care about their grades but not learning, procrastinate, and try to study for an exam at the last minute, or try to write a paper the day before it is due. Pintrich and Zusho (2002) provided an overview of current research on college student motivation and self-regulated learning, along with insights and suggestions for learning strategies interventions such as helping students be more organized and exerting more effort when they do not perform very well.

Around the same time, international researchers Zhu et al. (2008, 2009) examined cultural gaps in student perceptions of online collaborative learning, and the changes over time of student perceptions, motivation, and learning strategies due to the actual involvement in a collaborative e-learning environment. Parallel e-learning environments for first year, Flemish and Chinese students were implemented, and student perceptions of the online collaborative learning environment and their motivation and learning strategies were measured before and after the e-learning experience were measured. The findings showed that the Flemish group perceived the online collaborative learning environment more positively compared to the Chinese group. Chinese students' motivation and learning strategies, however, changed significantly in ways more in line with a social constructivist learning approach after the online collaborative learning experience. Zhu et al. (2008, 2009) are among many who now use culturally responsive research to help instructors become aware of and more supportive of different student perceptions of online collaborative learning environments.

## The Rise of Social and Emotional Learning (SEL) Approaches

The study of how children over time develop social and emotional skills was a topic of recent ongoing 8-year study by the Organisation for Economic Co-operation and Development (OECD, 2016). The focus was on children living in cities and aimed to better understand how teachers, parents, and communities "drive" their children's social and emotional development and how the development of these skills can help them later in life to have success in education and the world of work. This longitudinal study also sought to (a) identify future outcomes, including educational attainment, labor market, health status, relationships, and civic engagement; (b) understand how investments made by families, schools, and communities influence the development of skills; and (c) develop recommendations and measurement tools for policymakers and practitioners to better monitor and enhance social and emotional skills. Cities studied are members and non-members of OECD, and the populations studied are children in grades 1–7 of the approximate ages of 6–12. This study will follow the lives of a large number of children starting from grades 1 and 7 until early adulthood by collecting information on social-emotional skills, learning contexts, and future outcomes.

Other current research on social and emotional skills is reported in a new book by Elias et al. (2016), which seeks to

better serve the whole learner by looking at non-academic outcomes such as character development (CD) and SEL. They need to be reported so that parents and others concerned with their child's education can see SEL and CD outcomes as part of any school- or district-wide grading system. Their research products include guided exercises for analyzing existing report cards, samples and suggested report card designs, tips on improving communication with parents, and case studies highlighting common challenges. There are testimonials from teachers and students reflecting all of the important characteristics of an educational system geared to student success in developing the skills they need for the future. The key role played by SEL/CD in each student's development challenges the tradition of putting them at the back of the report card.

Greenberg (2017) has recently described emotion-focused therapy (EFT) and the adaptive role of emotion in human functioning. Research shows that the EFT approach leads to enduring change in effective emotional well-being. For those suffering from anxiety disorders, this theory and its constructs demonstrate one way in which early attempts to reduce anxiety through learning strategies interventions have evolved (e.g., Spielberger, 1972, 1977; McCombs, 1982a,b). These efforts began to change the way educators and policymakers viewed the function and purpose of schooling and the term "personalized learning" began to be the buzzword of the 1990s and early 2000s up to the present.

## Personalized Learning Evolves to Meet Whole Learner Needs

A recent critical look at how personalized learning has evolved and is likely to change in the future was undertaken by Bushweller (2016). Bushweller claims that personalized learning has not made the impact expected in the 1990s and early 2000s. Schools that have adopted a personalized learning approach still look like traditional schools did 5–10 years ago when digital tools were available but were not extensively used to individualize or tailor instruction to the strengths and weaknesses of individual students. Bushweller states this is due in part to educational and technological challenges of designing rigorous curricula and assessments around individual student interests. At the same time, however, Bushweller (2016) describes the current push to identify and design teaching and learning strategies around individual student's academic needs and personal interests—a trend that has entered and expanded into the K–12 mainstream.

In a similar vein, Kaplan (2016) recently examined how research continues to find few relationships between motivation and students' achievement. She claims this is due to an "infatuation" researchers have with particular concepts (e.g., goal orientations and self-efficacy) to the point they lose sight of the overall phenomena involved in how achievement is produced. This has led, Kaplan argues, to an under-determination of the role students' motivation actually plays in achievement—which itself is often a generalized contextual variable that lacks criterion validity. The result is the definition of what constitutes a quality education is narrowed, and the power of outcomes such as purposeful and meaningful learning, personal growth, creativity,

self-exploration, citizenship, and collaborative orientation are overlooked. Kaplan (2016) argues that research on the role of motivation in student achievement has become political, highlighting the need to design studies: (a) capturing the complex contextual and dynamic nature of this phenomena and (b) using rigorous methodologies grounded in validated theoretical assumptions that give the research a higher ideological or ethical foundation.

Others who have moved their focus on holistic learning strategies into the digital age include Don Norman (Norman, 2014; Norman and Stappers, 2016). These researchers are now exploring complex human-centered sociotechnical systems, including education, healthcare, transportation, governmental policy, and environmental protection. They concluded that the major challenges stem not from trying to understand or address the issues but arise during implementation, when political, economic, cultural, organizational, and structural problems overwhelm all else. It is suggested that designers play an active implementation role and develop solutions with small, incremental steps to reduce political, social, and cultural disruptions. This "muddling through" requires tolerance for existing constraints and tradeoffs, and a modularity that allows measures that do not compromise the whole. Others, myself included, have argued that rather than trying to make and measure incremental change, it is more promising to optimize the design with learner-centered principles and practices (cf. APA Task Force on Psychology in Education, 1993; APA Work Group of the Board of Educational Affairs, 1997; McCombs, 1998, 2000, 2012, 2013a,b, 2014; Scharmer, 2011; Senge, 2011, 2012; Scott, 2016).

## LEARNING STRATEGIES FOR THE WHOLE LEARNER

For the overall field of learning strategies, it is clear that within a whole learner perspective, learners of all ages and backgrounds seek to find meaning in what they are learning and personally generate their own meaning when needed or when effort is required (cf. McCombs, 2012). Like the influence of Frankl (1984), in my own research in the 1980s I was influenced by philosophies that acknowledged learner's epistemic curiosity and search for personal meaning in what they were learning. The role of the self was emerging as a growing area of interest during the 1970s and 1980s as discussed, especially by those researchers interested in self-regulated or self-directed learning (e.g., Rothkopf, 1970; Wittrock, 1974b; Entwistle and Hounsell, 1975; Knowles, 1975; Norman, 1976; Paris and Lindauer, 1976; Pressley, 1976; Bandura, 1977; Weinstein, 1978; Kopp, 1982; Brown et al., 1983a,b; Chipman et al., 1985; Good and Brophy, 1986; Palinscar and Brown, 1986; Shavelson et al., 1986; Vygotsky, 1986; Weinstein and Mayer, 1986; Perkins and Salomon, 1987, 1992; McCombs and Whisler, 1989; Schunk, 1989, 1994; Zimmerman, 1990, 2001; Zimmerman and Martinez-Pons, 1990; Salomon, 1993).

The current ongoing interest in self-assessments can be seen in a recent paper from the Educational Testing Service by Witherspoon et al. (2016). This paper demonstrates the interest in innovative ways to assess the teaching practice of



leading classroom discussion (LCD) in its National Observational Teaching Examination assessment series. In this assessment, candidates interact with a small class of virtual students represented by avatars in a computer-based, simulated classroom. Five avatars are enacted by a single simulation specialist who has been trained and certified on an elementary English language arts or mathematics task. The construct of LCD is defined and a review of the research and scholarly literature provided that supports the importance of this self-assessment practice for effective teaching. Other studies of similar innovative approaches to studying the whole learner with twenty-first century technology continue to surface daily, making them too numerous to bring to this already lengthy review.

## Leading the Way to Learner-Centered Educational Systems

Looking at how learning strategies research has evolved into the affective and motivational realms, I continue to be a fan of self-determination theory (Deci, 1975, 1980; Deci and Ryan, 1985, 2000, 2002, 2006; d'Ailly, 2003, 2004) and the innate health/health realization model of Roger Mills (cf. McCombs, 1986a, 1991a,b; Mills, 1991). These theoretical orientations place the person at the center of the learning paradigm but more importantly emphasize the importance of innate psychological needs (competence, control, and agency) and working from an inside-out perspective when facilitating learning. Placing the responsibility for learning on the learner while at the same time, understanding that to be motivated by a will to learn, the context must attend to how much learner control is present, whether relationships are caring and supportive, and whether opportunities are present to develop competence in areas that matter to the learner. These practices are based on foundational principles of learning.

International work begun two decades ago with a wave of student voice research surfaced in the 1990s and early 2000s (e.g., Fielding, 1997, 2007; Rudduck, 1998; Rudduck, 2006). At the same time, many US researchers were providing theoretical and applied self-theories and theories of self-regulated learning (e.g., Deci and Ryan, 1985, 2000; Zimmerman and Schunk, 1989, 2001, 2003; Schunk and Zimmerman, 1998, 2007; Ryan and Deci, 2000) that mirrored the importance of student control and participation in their own learning processes. Expanding the learning strategies agenda to include “student voice,” Michael Fielding (Fielding and Kirby, 2009; Fielding, 2011, 2015a,b) at the University of Cambridge in the UK, recently, updated his more than 20 years of research demonstrating significant gains in broadly defined student outcomes when students are given significant voice and control over their own school learning (Fielding, 2015a,b). These outcomes included increases in student creativity, teamwork, collaboration, problem solving, and academic achievement.

Other influential researchers from the UK such as Sir Ken Robinson<sup>1</sup> lobby for educational systems that are learner centered and accept the assumptions of innate curiosity, love of learning, and need for autonomy and control in the learning process. These

researchers are making popular the concept of a major education paradigm shift, as are some of our US researchers, including David Berliner (Berliner, 2000, 2009; Tobias et al., 2016), Alfie Kohn,<sup>2</sup> and Charlie Reigeluth (cf. Reigeluth, 1994; Reigeluth et al., 2017). In communications and collaborations with these researchers, I have accepted the legitimacy and importance of taking the applied research results from learner-centered educational paradigms to the public, aiming to influence policy and practice. In my immediate circle of professional friends and colleagues, well-recognized academic researcher Harter (2006, 2012, 2016), whose lifelong study of the developing self, has been a major contributor to my own thinking and research on the role of the self in self-regulated learning strategies.

Reigeluth et al. (2017) have looked thoughtfully at what others leading movements toward a learner-centered paradigm of education include in their models. They also address and update what instructional design theories and models can contribute to our understanding of what constitutes a personalized integrated educational system. Reigeluth's (Reigeluth et al., 2017) chapter on how to design technology interventions to provide the supports for the truly learner-centered instruction outlined in the first chapter of this edited book. The four major functions required to support students include recordkeeping for student learning, planning for student learning, instruction for student learning, and assessment for/of student learning and three secondary functions include communication and collaboration, system administration, and improvement. If developed fully, Reigeluth maintains that this platform can support the implementation of all five learner-centered principles: attainment-based instruction, task-centered instruction, personalized instruction, changed roles, and changed curriculum.

Taking these integrated, personalized learning system views to another level, there are a number of researchers in the private and public sectors arguing for the globalization of education and the use of advanced artificial intelligence, virtual reality, and robotic technologies (e.g., Senge et al., 2000; Calvert, 2016; Davis, 2016; Latham et al., 2016; Norman and Stappers, 2016; Scott, 2016; Vander Ark, 2016a,b). The basic argument is that these systems will be more efficient and effective, reducing teacher workloads and allowing students to take increasing responsibility and control over their own learning any time and any place. For example, Vander Ark (2016a,b) presents a case for robotic teachers who focus on relationships but do not get tired. Despite this case, teachers and human relationships still matter—as they did in the 1980s as part of our studies for the military (cf. McCombs, 1982a,b, 1984a,b, 1985, 1986a,b,c, 1987; McCombs and Lockhart, 1984; McCombs et al., 1986a,b, 1987).

## HOW THE FIELD OF LEARNING STRATEGIES RESEARCH HAS EVOLVED

The evolution of learning strategies research in basic and applied areas is a complex one that has branched into what are now fairly well-defined specialties. A concern with *strategies to*

<sup>1</sup><http://sirkenrobinson.com/>.

<sup>2</sup><http://www.alfiekohn.org>.

*support mindfulness* began with Langer's (Langer, 1989) initial definition of this construct as one that involves deliberate effortful abstraction and a search for connections. More recent research on "mindfulness" by Oaklander (2016) described "The Mindful Classroom" in an article for *Time* magazine. A fifth-grade classroom in Louisville, KY, USA is described where students practice twice weekly peaceful activities such as relaxation exercises that focus them for 45 min on the present moment. Children have been noted to be highly anxious and stressed out, having trouble paying attention, and worried about bullying. A follow-up *Time* magazine article by Schrobsdorff (2016) reinforced this finding and focused on American teens and the often debilitating anxiety facing them in today's world and times. "Mindfulness" advice for teens and adults who care for them, however, is often a non-scientific or "Buddhist-type" soft approach to calming children and the adults around them is often criticized—distracting schools from their fundamental responsibility of educating students in rigorous curriculum standards or common core goals (Briggs, 2015).

Another huge shift in *how twenty-first century strategic interventions are defined* is exemplified by recent efforts promoted by UCLA's National Center for Research on Evaluation, Standards and Student Testing (CRESST) at their 2016 conference on September 21–22. The conference featured thought leaders in technology, academia, education, and policy leading discussions on the latest evidence-based global trends and opportunities in education. Speakers included Li Cai, CRESST director, and UCLA professor of education and psychology; Pedro Noguera, UCLA distinguished professor of education; John Hattie, director, Melbourne Educational Research Institute, University of Melbourne; and Alan Kay, president, Viewpoints Research Institute. The main speakers were video-recorded, and these were posted to several YouTube locations, with examples accessible at: [https://www.youtube.com/watch?v=-jPAgwjHp\\_c](https://www.youtube.com/watch?v=-jPAgwjHp_c), <https://www.youtube.com/watch?v=2rnGiJTUtl0>, and [https://www.youtube.com/watch?v=c\\_fl\\_z7K-dw](https://www.youtube.com/watch?v=c_fl_z7K-dw).

In listening to these presentations, it becomes clear that the field of learning strategies research is evolving nationally and internationally in novel, dynamic, transformative, and innovative ways. How research data on individual student and contextual levels are being used to inform the science of learning is a major focus with a variety of principles and warnings about the role of high quality designs for learning systems and personalized educational interventions using technology. Using the body of knowledge, we already have about student learning and the strategies that best promote learning at deep levels was an organizing theme of this conference. A primary area of concern was *how to refine our interventions for increasingly diverse students with more than cognitive learning needs*—an exciting contribution of this gathering.

Similarly, Goodwin (2016) has identified research showing how Coleman's (Coleman, 1966; Goleman, 1995) early work with over 4,000 schools across the US on overcoming the effects of poverty led to the conclusion that *non-school factors such as teacher quality outweighed school characteristics such as size and resources*. The most important finding in the huge 800-page report was that a single student attitude factor showed a stronger relationship to

achievement than all the school factors combined. This factor was *how strongly students believed they could control their own destinies* and those impoverished minority students who did feel they could control their destinies had higher levels of achievement than white students who lacked these convictions. Later studies confirmed these findings (e.g., Ekstrom et al., 1986; Finn and Rock, 1997) with high school dropouts who were more likely to attribute school success to external factors such as luck [see early and ongoing attribution theory research of Weiner (2016), at [https://www.researchgate.net/profile/Bernard\\_Weiner](https://www.researchgate.net/profile/Bernard_Weiner)].

More recently, several studies reveal how *combining feelings of control of one's life with other motivational variables such as academic self-efficacy and goal orientation* can account for more than 20% of the variance in university students' academic grade point averages (e.g., Cadinu et al., 2006; Richardson et al., 2012). These findings have been replicated in my own work with San Antonio College over 5 years, 2006–2011 (McCombs, 2008, 2010, 2011a,b, 2012; McCombs and Price, 2008) along with lower dropout rates for students in learner-centered compared to non-learner-centered classrooms. Motivational variables that most predicted retention and academic grades included academic self-efficacy, achievement goal orientation, low effort avoidance strategies, and knowledge seeking curiosity.

Another specialization emerging today is *how to engage learners in digital learning environments*, including data-driven, information management, and dynamic learning systems. There has been a big push for at least two decades both in the US and globally for using technology and digital learning environments in ways that personalize what students learn. One of the most recent was presented in a special report in *Education Week* on how personalized learning addresses the next generation of learners (cf. Bushweller, 2016). This special report looked critically at how personalized learning has evolved and what its future looks like given it is not sweeping through schools given the "thin" nature of the research evidence for academic gains with comprehensive personalized learning systems. The biggest issue per Bushweller is that teachers are not eager to change the way they teach and develop new kinds of curricula and assessments with current demands for teaching to common core standards assessed by state and national standardized tests. What the research says is discussed by Harold (2016) who maintains that despite the millions spent privately and nearly half a billion publicly to support the movement to more personalized K–12 education, evaluations have provided little conclusive evidence of the benefits of such systems. Issues revolve around how personalized learning is defined, the contexts in which such systems are implemented, and the types of software systems that support teacher efforts to provide learning materials tailored to individual student needs within and across different content areas.

A sixth area is *biological and neuroscience applications*. In this area, Mayer (2001, 2003, 2005, 2011) has continued the research of his colleague, Merl Wittrock, and continued to explore how brain research can inform our approaches to learning and instruction. In his recent review, Mayer (2016) explores how neuroscience has the potential for improving educational practice if viewed as linking conceptually with cognitive science, educational psychology,

and educational practice. This paper explores the potential of neuroscience for improving educational practice by describing the perspective of educational psychology as a linking science; providing historical context showing educational psychology's 100-year search for an educationally relevant neuroscience; offering a conceptual framework for the connections among neuroscience, cognitive science, educational psychology, and educational practice; and laying out a research agenda for the emerging field of educational neuroscience.

Finally, *adaptive or individualized educational systems for meeting the needs of an increasingly diverse student population* (including those with developmental or socioemotional learning issues). One of the early pioneers of the learning strategies movement, Alexander (2016), was honored recently by the Benchmark Center for Empowered learning for her significant contributions to how curriculum and instruction is informing their professional development seminars. She has been involved since 2001 in informing teachers about twenty-first century student needs to be knowledge builders and use goal-driven thinking strategies to function effectively in today's world. Alexander's current research has helped teachers and their students confront the realities of twenty-first century cultural and information processing realities. As a cautionary note, Scott (2016) points out that although the promise of personalization is there with the right approach to technology interventions, gadgets in the classroom do not improve learning—addressing the needs of individual learners is a complex interaction of students, teachers, and technology tools.

In looking back at the roots of the adaptive learning systems that were part of my graduate school education at Florida State University in the late 1960s and early 1970s, the most influential work was being done by Benjamin Bloom (Bloom et al., 1956), Gagne (1971), and my major professor, Duncan Hansen (Leherissey et al., 1971) who studied under Suppes at Stanford University. We were ahead of the times in studying adaptive learning systems, systems and instructional design models, and strategies for enhancing learning in computer-based learning environments. A look where more than 50 years of military research has revealed about the myth of average is provided by Perez (2016) who argues that we now know there is no average learner and systems must adapt instruction to learner variability from the start.

Some of the latest findings from neuroscience and brain imaging studies have further challenged the idea of average in relation to how the brain learns. Perez (2016) also contends that despite existing evidence, the trend toward personalized education is being resisted by all but innovative educators. Schools continue to design education around an average learner in one-size-fits-all learning approaches. He argues for a universal design system that uses the latest developments in technology to make the implementation of adaptive instructional strategies easier for educators to adopt. Similarly, Scott (2016) warns that big data and learning management systems may help in the implementation of personalized learning but they can also interfere with the human touch needed from teachers, peers, and others that connect with digital natives in our twenty-first century schools and prevent the shallow learning that may occur.

## CURRENT RESEARCH DIRECTIONS AND FURTHER QUESTIONS

My own work over more than 25 years, aimed at examining learning strategies through the lens of learner-centered principles and practices, has led to an advocacy for ecologically sound systems that use 360-degree evaluation methodologies (cf. McCombs, 2013a,b, 2014). This review has provided another lens through which to examine the research directions and major findings emerging in educational psychology as the field. What is evident from basic and applied learning strategies research is that the concepts, contexts, and communities of practice have grown, debated, and changed directions. But overall, this research area has become more well integrated into the national and international dialog, research partnerships, and collaborations with culturally diverse researchers, practitioners, and policymakers. It is clear from this selective historical review of theory, research, and practice with a growing yet simplified list of interacting and overlapping learner variables that the field and concept of learning strategies has grown in importance and visibility.

Many ongoing studies using complex mixes of student populations, their teachers, and their families (or other mixed age, gender, and grade level groups) show that students thrive as whole persons when they perceive they are in learning environments with supportive on- or offline mentors and tools to become self-motivated, self-regulating learners in both traditional and progressive school contexts. We can confidently assert that learning strategies research will continue to evolve into a more coherent and robust field of study that is being joined by experts from cognitive science as well as related fields such as neuroscience, human development, sociology, health or medicine, economics, organizational psychology, business, and even anthropology. The question is where is the field now and where are we going?

My view is that the concept of “*learning strategies*” remains much the same as when it was officially conceived by twentieth century researchers who broke set with behaviorist approaches that take an outside-in look at learner and learning processes and interventions. The original definition of cognitive and information processing experts doing research in military training contexts more than 50 years ago still holds today (cf. Dobrovolny et al., 1979; McCombs et al., 1979; McCombs and Dobrovolny, 1980a,b; McCombs et al., 1983):

From a cognitive-behavioral perspective, learning strategies help students manage and regulate their own learning goals while teaching strategies facilitate students' personal responsibility for their own learning by instructing them in the cognitive, attentional, and motivational processes and strategies associated with effective and efficient student learning and training outcomes.

Within the constructivist theoretical framework selected for defining instructor roles in 1980, the basic assumption in CMI systems captured what we know today: the student is responsible for his or her own learning. Given that this assumption had and

continues to have implications for what instructors or teachers of students in all age groups are taught about their primary roles, instructors in this 1980 course learned that specifically students are expected to be responsible for attentive and motivated, making learning meaningful by the appropriate use of learning strategies and skills, initiating their own self-directed or self-paced learning, interacting effectively with both their peers and their instructors, and setting appropriate course and life goals (McCombs et al., 1983).

In our more recent work with online learning environments, my colleagues and I have focused on the extent that students having learning problems in synchronous or asynchronous learning environments or are unable to effectively exercise the above responsibilities (McCombs and Vakili, 2005; Hannum and McCombs, 2008; McCombs, 2008). In outlining the research-validated principles and practices that provide a foundation for online learning, we made sure the instructor or teacher guidelines included a thorough understanding of the set of learning strategies that will facilitate students' increase in personal responsibility and learning confidence (Meece, 2002; McCombs, 2011a,b, 2012, 2013a,b, 2014). Thus, within the Learning Facilitator Instructor Role, a major training goal included familiarizing instructors with the kinds of cognitive, attentional, and motivational processes and strategies that are associated with effective, responsible, goal-oriented, and self-competent student learning.

## ENDURING LEARNING STRATEGIES RESEARCH CONCERNS

What also continues to hold true is the need for teachers or instructors in training contexts to address both the function of learning management and facilitation of learning as defined early on by our research on instructor role training interventions in computer-based environments evaluated in Air Force, Army, Navy, and Marine Corp training environments (Carver et al., 1977; McCombs and Dobrovolsky, 1980a,b, 1982; McCombs and McDaniel, 1981, 1983; McCombs et al., 1983, 1984; Back and McCombs, 1984, 1985; McCombs, 1984b, 1999, 2000, 2002; McCombs and Lockhart, 1984; McCombs and McNabb, 2001). Similarly, in public and private K–12 and college educational contexts, those advocating personalized learning argue that technology is a tool but not a substitute for good teachers and good teaching practices that include teaching critical thinking and other proven learning strategies (e.g., Harold, 2016).

An interesting set of commentaries has recently appeared in the literature that questions the research methods and federally required criteria for evaluating the effectiveness of replicable educational interventions. Some of the most recent (Editorial Projects in Education Research Center, 2011; Bill and Melinda Gates Foundation, 2014; Layton, 2015; Malouf and Taymans, 2016) have questioned whether findings of little or no impact from recent goals set forth in the No Child Left Behind, What Works Clearinghouse, or Race to the Top acts are a function of too much reliance on credible evidence-based methods and experimental approaches that may in fact mask real effects uncovered by more collaborative and qualitative findings (e.g., from case studies and classroom observations and survey research).

These arguments are not new and, in fact, surfaced early in the educational reform agenda and/or military training intervention research that relied on rigorous randomized studies with matched control groups and statistically significant outcome data or effect sizes that were at odds with the real achievement or performance goals of these interventions (Howard, 1986; Robson, 2002). For example, in the early days of individualized computer-based training interventions or self-paced instructional approaches, an over-reliance on linear modeling or factor analytic versus self-report assessments or observational research methods was a theme of methodologists (such as Glaser, 1963; Atkinson and Shiffrin, 1968; Wang, 1968, 1992, 1997; Resnick and Wang, 1969; Chu and Schramm, 1975; Cronbach, 1975; Snow, 1976, 1989; Cronbach and Snow, 1977; Snow et al., 1980; Perkins and Salomon, 1992; Cronbach and Shavelson, 2004).

During the 1980s and until the early 2000s, others were looking at whole school reform models such as Slavin's comprehensive reading improvement model and Wang's (Wang, 1992; Taylor and Wang, 1997) adaptive strategy-based model for addressing achievement gaps among school-age children in low performing schools. These school reform models led researchers to question the reliance of program evaluations on methodologies that put little value in non-randomized single case or correlational studies demonstrating larger effect sizes than those of large scale matched control studies (cf. Wang and Walberg, 1985; Branson, 1987; Cohen, 1990; McCombs, 1991c, 2009; Baker et al., 1994; Wang et al., 1994; McCombs and Quiat, 2002; McCombs and Vakili, 2005; Berliner, 2009; Slavin, 2011).

As I have heard many say over my 50-year professional career, "there is nothing new under the sun" and "we step on the toes of research leaders rather than stand on their shoulders." It is gratifying albeit frustrating at times to realize that in the field of learning strategies I have seen both sayings come true. On the gratifying end, is how learning strategies are now defined.

## EVOLUTIONS (OR NOT) IN DEFINITIONS OF "LEARNING STRATEGIES"

Weinstein and Mayer (1986) defined learning strategies broadly as "behaviors and thoughts that a learner engages in during learning" that are "intended to influence the learner's encoding process" (p. 315). Mayer (1992, 1998, 2001) later specifically defined these strategies as behaviors of a learner that are intended to influence how the learner processes information. Self-regulation (Zimmerman, 1989, 2000) describes how individuals manage their personal learning process, especially how to plan, monitor, focus on, and evaluate their own learning. These early definitions from the educational literature reflect the roots of learning strategies in cognitive science, with its essential assumptions that human beings process information and that learning involves such information processing. Other researchers (e.g., Paris et al., 1984; Swartz and Perkins, 1989; Blakey and Spence, 1990; Barrell, 1995; Owens, 2016) claim that learning strategies are involved in all learning in and outside of school contexts, regardless of the content. Thus, a mix of learning strategies is recommended for use in the learning and teaching math, science, history, languages,

and other subjects, in classroom or online learning settings and more informal learning environments.

The above definitions coincide with Nambiar's (Nambiar, 2009, p. 144) conclusion from his review of research from the mid 1950s through 2009:

The 1970s work was tied closely to cognitive psychology and the later research distinguished different groups of strategies. The work in the 1980s simply forged ahead with lists of strategies used by successful learners and did not ground the work in theory. Researchers in the 1990s made profitable use of such reliable strategy lists and set out to conduct research investigating the factors that impacted the use of learning strategies.

This applied research focus continues through the present time and has emerged in recent studies in both traditional and digitally mediated contexts with results supporting a whole child, holistic view of what constitutes the ideal learning environment (cf. McCombs, 1993, 2010, 2011a, 2012, 2013a,b, 2014; Reigeluth and Garfinkle, 1994; Reigeluth et al., 2017).

## A New Paradigm of Strategic Learning

The ongoing contribution of Weinstein and Mayer's (Weinstein and Mayer, 1986) research for learning strategies research was recognized by Tsai (2009) whose Model of Strategic e-Learning was used to explain and evaluate student e-learning from metacognitive perspectives. An in-depth interview, pilot study and main study were used to construct the model and develop the Online Learning Strategies Scale (OLSS). The model framework has four dimensions of characteristics of e-learning environments and three core domains (perceived-skill, affection, and self-regulation) of student e-learning strategies. The OLSS instrument provides a diagnostic instrument for e-learning researchers, system designers, curriculum developers, and instructors to evaluate students' e-learning strategies in their experiment, design, and development. Although instructors can accommodate students with different levels of metacognitive skills by selecting suitable teaching objectives and activities, Tsai (2009) pointed out that curriculum design and instruction are also needed to develop student metacognitive abilities and provide scaffolding for students to use holistic learning strategies for facilitating their learning achievement and motivation as suggested by Weinstein and her colleague's research (Weinstein and Mayer, 1986; Ridley et al., 1994; Weinstein and McCombs, 1994, 1998).

Tsai (2009) concluded that Weinstein's (Weinstein, 1978) concept of "strategic learning" explained student learning strategies based on metacognitive perspectives. Weinstein and her colleagues (Weinstein, 1978; Weinstein and Palmer, 1990) are further credited with the development of the "LASSI" to diagnose the strengths and weaknesses of students in relation to the above aspects of learning strategies. To elevate the empirical value of the LASSI for a wide range of young adults, Cano (2006) conducted an in-depth analysis to validate the LASSI, which involved conceptually grouping LASSI subscales into three categories:

affective strategies, goal strategies, and comprehension monitoring strategies. These three main categories were then shown to be involved in what Weinstein (1978) called strategic learning that she validated in diverse learning contents and content areas. Thus, modifying the construct of strategic learning of Weinstein (1978) became necessary and provided an impetus for the latest version of the LASSI (Weinstein et al., 2016). This version of the LASSI and my personal tribute to Dr. Weinstein is included as Supplementary Material at the end of this article.

## SUMMARY AND CONCLUSION

From this selective but broadly based historical review of learning strategies research over the past more than 50 years it is clear that the field is thriving. Research on "learning strategies" began in the 1960s and received significant funding from the Defense Advanced Research Projects Agency in the early 1970s. Invitational conferences were held that included well-known researchers and graduate students who were identifying various study and other learning strategies in their doctoral programs. This was a new direction and had its foundations in generative learning theory (Wittrock, 1974a), Bandura's (Bandura, 1963, 1972) cognitive-behavioral theories, Glaser (1963), Glaser and Resnick (1972), Glaser and Strauss (1967), and Seidel's (Seidel, 1969, 1971) adaptive learning theories, and individualized learning theories of Richard Snow (1974, 1977) and Cronbach (1951, 1957, 1975) and Suppes (1972, 1973). It led to exploring computer-based individualized instructional modeling based on complex empirical algorithms and heuristics predicting learning and training task performance (Parkhurst and McCombs, 1979). Those who began and continued researching learning strategies are now leaving research legacies to their graduate students, institutions, researchers, and practitioners at large.

This historical review revealed that a focus on metacognition is one unifying theme. Metacognitive strategies have continued to prove effective for diverse student populations and language learners, with findings that support both general learning strategies and task-specific strategies. A second unifying theme is a focus on the whole learner and on interventions that address cognitive, metacognitive, affective, physical, cultural, and social needs. Learner-centered principles and practices are becoming more widely used in both traditional and more innovative digital environments that recognize the value of close mentoring relationships and caring support as well as collaborative, culturally responsive, rigorous learning goals, and shared responsibility and accountability for student learning success.

Major theoretical orientations continue to be based in cognitive science but are increasingly being linked to other sciences such as motivational psychology, social and emotional intelligence, neuro-psychology, brain studies, and a variety of social and engineering sciences. Researchers looking at military training and psychological issues such as the growing number of post-traumatic stress disorders and suicides among enlisted and returning military personnel are also a direction where current learning strategies research holds promise. Many of the effective interventions for military personnel may also be

of value in addressing growing stress and emotional disorders among adolescents, including the rising suicide rate in middle and high school population nationally and internationally. The field is likely to grow and expand into the future with ongoing needs to further refine and design learning strategies that meet the needs of learners in an increasing complex and diverse nation and world.

It is gratifying to know that the learning strategies research field has found favor and funding during my professional career and is still growing and expanding into new and exciting twenty-first century areas. It is even more gratifying know that a dear friend and colleague—Dr. Claire Ellen Weinstein—was one of the main contributors during her lifetime in the learning strategies research and practice arena.

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## AUTHOR CONTRIBUTIONS

BLM is the primary author of this manuscript. She provides a historical review covering 50 years of learning strategies research, filling gaps not covered in other recent reviews. The review also provides a tribute to Dr. Claire Ellen Weinstein who passed in June 2016 for her pioneering work on learning strategies that is included as a Supplementary Material to this review.

## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at <http://journal.frontiersin.org/article/10.3389/feduc.2017.00006/full#supplementary-material>.

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