Learning Strategies as Metacognitive Factors: A Critical Review

Prepared for the Raikes Foundation by the
Educational Policy Improvement Center

David T. Conley, PhD
Founder and CEO

Acknowledgements

The author wishes to acknowledge the contributions of Dr. Liz French to the literature review and Ms. Erin Fukuda to the example programs, in addition to their contributions to the structure and conceptual design of this research brief.

About the Educational Policy

EPIC's mission is to improve educational policy and practice that will increase student success, particularly with students historically underserved by public schools. EPIC conducts a range of policy-related research studies and develops practical tools and techniques to support a dramatic improvement in college and career readiness for students. EPIC is distinguished by its pioneering use of state-of-the-art, criterion-based, and standards-referenced methods of course and document analysis.

Conley, D. (2014). *Learning strategies as metacognitive factors: A critical review*. Eugene, OR: Educational Policy Improvement Center.

Educational Policy Improvement Center
1700 Millrace Dr.
Eugene, Oregon 97403
Phone: 541-246-2600
www.epiconline.org

Published September 2014

Table of Contents

Introduction

Every day students face multiple complex tasks—things that require more than an automatic response. They could include developing a strategy for a new project, assignment, or task; being asked to lead a team of peers; taking the initiative to gather information for a research paper; managing personal time to juggle multiple priorities and complete a complex task during several days or weeks; or seeking help when unable to solve a problem or complete an assignment using regular techniques and strategies. Students' abilities to complete and learn from each learning task successfully depend on more than their content knowledge. Success depends on how well they can identify, select, evaluate, adjust, and implement appropriate strategies for applying what they know in tackling the task at hand. Their success is influenced by their perception of whether the task is meaningful, if they believe they can succeed, how high they aspire to achieve, what level of achievement they need to pursue their life goals, and how well they can regulate their mindset to persist.

Learners approach complex tasks with a range of techniques they derive largely from experience, ingenuity, and—for a lucky minority—formal instruction in learning skills and strategies. They use metacognition to monitor the relative effectiveness and success of any specific technique they use and then self-regulate to redirect their strategy as needed. This ability to be self-aware and reflective is at the heart of metacognition and the self-regulatory processes that allow learners to become progressively more effective at learning, particularly in formal academic settings. When considering the complex tasks students face daily, it becomes clear that preparing them for success in school, work, and life requires intentional efforts to encourage the development of a variety of learning strategies and skills that improve their effectiveness in acquiring content knowledge and that facilitate their application of that knowledge in complex and nonroutine ways.

Learning strategies are among a group of factors that traditionally have been called noncognitive skills, in contrast to the more common cognitive skills, which refer largely to content-knowledge acquisition and retention. This label is a somewhat ironic and not entirely appropriate, given that these learning skills require more ongoing cognitive processing than many content-acquisition tasks.

Although the labels to describe these learning skill constellations vary from terms such as "noncongitive skills" (Heckman & Rubinstein, 2001) and "noncognitive factors" (Farrington et al., 2012), this paper adopts the concept of metacognitive learning skills to describe the thinking that students use to manage and navigate the learning process. Conley (2013) presents a rationale for shifting from the term noncognitive to the notion of metacognition to describe student-learning functions:

> Perhaps it's time to think of noncognitive dimensions of learning as forms of thinking, rather than as a process that does not involve cognition. Are we not observing a higher form of thinking when we see students persist with difficult tasks, such as overcoming frustration; setting and achieving goals; seeking help; working with others; and developing, managing, and perceiving their sense of self-efficacy? Are these qualities not at least as important as knowing how well students recall information about the year in which the Civil War began, or how to factor a polynomial? Might what we observe when we look for noncognitive factors be a more complex form of cognition—a result of executive functioning by the brain as it monitors and adjusts to circumstances to accomplish specific aims and objectives? In other words, might these behaviors be manifestations not of feelings, but of metacognition—the mind's ability to reflect on how effectively it is handling the learning process as it is doing so?

However, the path toward identifying, labeling, teaching, and assessing these skills is complex and raises many questions. How much agreement exists on what these skills are? Are certain skills more important than others? How challenging is it to know when a student is using a learning skill? Can they be measured reliably and efficiently? Can teachers actually teach them? Do some students already have more opportunities to learn and use these skills than others do? Can or should schools be held accountable for students demonstrating these skills?

The concept of metacognitive skills has a long history, and educators have long shown an interest in cultivating these skills in students. Researchers in cognitive psychology, workplace success, and education have established the existence and importance of intentional, self-regulated, reflective learning. However, numerous challenges remain to be surmounted before metacognitive learning skills are viewed as being equal in importance and relevance to content-knowledge acquisition and are understood to be the complement to content mastery.

This paper builds on work reported by Farrington and others in 2012 when they assembled a broader framework for noncognitive factors, of which learning strategies were a part. The paper begins by comparing the Farrington model with other models of learning strategies, proceeds to considering examples of innovations in the field, and concludes by identifying implications for the field moving forward. The intent of this paper is not to advance a singular definition, model, or implementation process for learning strategies, but rather to review the current state of the field and the issues that need to be understood and confronted to move beyond research and toward action. Schools in the United States are uniquely local in their orientation and governance, which enables them to develop programs that can be adapted to their contextual needs and interests.

This variation, which can lead to innovation and initiative, can also mask serious inequities. Students in some schools may be receiving the benefit of instruction that helps them identify and develop metacognitive learning strategies, while students in the school down the road may not be receiving any of those opportunities. Unfortunately, the assessment system used in most schools and essentially all states, focuses almost obsessively on English and mathematics scores and gathers little or no data about student learning skills. As states and schools continue the decades-long effort to close the achievement gap in reading, writing, and mathematics, they often overlook the fact that their educational programs may be transmitting content knowledge but that many students are not particularly effective at retaining and applying that knowledge because they lack the necessary learning skills necessary. This deficit creates a new kind of gap, between students who have a repertoire of learning strategies and those who do not. Even if states and schools reach the point where all students score comparably on English and mathematics tests, they will still be confronted by the troubling gap between those students equipped to continue as independent, self-reliant learners capable of taking on a wide range of new learning challenges and those who are able to learn only what is presented to them in a structured fashion in a formal didactic classroom setting.

Getting this notion of a learning gap into the public arena and policy makers' consciousness will require collaboration across research, policy, and practice communities. This paper seeks to move the dialog forward, beyond the summaries of research. It examines many of the actions that are being undertaken by schools and organizations devoted to developing these skills and closes with an examination of state activities in this area and the necessary steps to create schools and school systems in which all students acquire the capabilities to be effective, strategic lifelong learners who can succeed in a dynamically changing economy and society.

What Are Learning Strategies?

Learning strategies are a form of metacognition. Metacognitive thought of this nature consists of individual self-regulation for the purpose of evaluating one's behaviors to select effective learning behaviors. Metacognition occurs when learners demonstrate awareness of their cognitive processes and then monitor and analyze those processes. Metacognition also encompasses the individual's perceived ability to adjust strategies successfully (Flavell, 1979). Individuals use metacognition when they recognize the sensation of being able—or unable—to succeed at a task, then ascertain what they are doing that seems to be working and what seems not to be working. Based on this reflective analysis, they then accordingly adjust their behavior, which could entail any of a range of choices about the strategies they need to pursue to be successful. All of the noncognitive factors identified by Farrington and colleagues (2012), fall under the category of metacognition (see Conley, 2013).

Figure 1.1. Learning Strategies Models

Flavell (1979)	Weinstein & Mayer (1986)	O'Malley & Chamot (1990)
• Metacognitive knowledge • Metacognitive experience • Goals or tasks • Actions or strategies	• Basic rehearsal • Complex rehersal • Basic elaboration • Complex elaboration • Basic organizational • Complex organizational • Comprehension monitoring • Affective and motivational	Metacognitive Strategies • Plan/organize • Manage • Monitor • Evaluate Task-Based Strategies • Use what you know • Use your imagination • Use your organizational skills • Use a variety of resources
Pintrich, Smith, Garcia, & McKeachie (1993)	**Farrington et al. (2012)**	
Cognitive Strategies • Rehearsal • Elaboration • Organization • Critical thinking Metacognitive Strategies Resource Management Strategies • Effort management • Peer learning • Help-seeking	• Study skills • Metacognitive strategies • Self-regulated learning • Time management • Goal-setting	

Figure 1.2. Learning Strategies Within Broader Models

Hewlett (April 2013)
Learn how to learn.
Students monitor and direct their own learning.

- Students set a goal for each learning task, monitor their progress towards the goal, and adapt their approach as needed to successfully complete a task or solve a problem.
- Students know and can apply a variety of study skills and strategies to meet the demands of a task.
- Students monitor their comprehension as they learn, recognize when they become confused or encounter obstacles, diagnose barriers to their success, and select appropriate strategies to work through them.
- Students work well independently but ask for help when they need it.
- Students routinely reflect on their learning experiences and apply insights to subsequent situations.
- Students are aware of their strengths and weaknesses and anticipate needing to work harder in some areas.
- Students identify and work toward lifelong learning and academic goals.
- Students enjoy and seek out learning on their own and with others.
- Students anticipate and are prepared to meet changing expectations in a variety of academic, professional, and social environments.
- Students delay gratification, refocus after distractions, and maintain momentum until they reach their goal.
- Students use failures and setbacks as opportunities for feedback and apply lessons learned to improve future efforts.
- Students care about the quality of their work and put in extra effort to do things thoroughly and well.
- Students continue looking for new ways to learn challenging material or solve difficult problems.

National Research Council (2012)
Deeper Learning
Interpersonal Domain

Competency clusters
- Intellectual openness
- Work ethic and conscientiousness
- Positive core self-evaluation

Example competencies
- Flexibility
- Initiative
- Appreciation for diversity
- Metacognition

Conley (2014)
Key Learning Skills and Techniques

Ownership of learning
- Goal setting
- Persistence
- Self-awareness
- Motivation
- Help-seeking
- Self-efficacy

Learning techniques
- Time management
- Test-taking skills
- Note-taking skills
- Memorization and recall
- Strategic reading
- Collaborative learning
- Technology

Raikes Foundation (2013)[1]

Goal setting and goal management
- Self-discipline and ability to stay focused
- Persistence

Use of metacognition
- Skills to aid remembering, thinking, and learning
- Self-monitoring
- "Learning about learning"
- Adjusting behavior to tackle challenges

Leveraging social capital to achieve goals (relationships)

[1]The Raikes Foundation does not offer a learning strategies model per se, but it presents a list of the characteristics of learners who demonstrate agency. For the purposes of this paper, agency is considered to overlap with learning strategies, although the two are not deemed to be exactly the same.

Learning strategies are the things students do to enable and activate thinking, remembering, understanding, and information processing more generally. Various researchers have provided complementary descriptions and definitions throughout several decades that describe self-regulated learning or deeper learning in greater detail and in operational terms (for example, Conley & French, 2014; Farrington et al., 2012; Flavell, 1979; William and Flora Hewlett Foundation, 2013; O'Malley & Chamot, 1990; Pintrich, Smith, Garcia, & McKeachie, 1993; Weinstein & Mayer, 1986; Zimmerman, 2002) or student agency (Raikes Foundation, 2013). The specific components of these theoretical models differ, but models consistently reflect three broad categories of learning strategies or techniques: metacognitive, self-regulatory, and task-oriented (see Figures 1.1 and 1.2).

Metacognitive Learning Skills

Metacognitive learning strategies are a specific application of metacognition. They are the behaviors appropriate for and relevant to improving performance on a specific learning task. Learners engage in metacognition when they self-assess their mastery of prerequisite skills and knowledge necessary to complete a task successfully, monitor their progress and the effectiveness of their overall approach to a task, and select appropriate task-specific strategies such as using context clues to derive the meaning of unfamiliar words or seeking help from a teacher or peer when an initial approach to a task is unsuccessful.

Learners with strong metacognitive learning strategies routinely use them without much need for prompting. In fact, the very nature of metacognitive learning strategies is that they are self-regulated by the learner. In some senses, this attribute makes them more challenging to develop, particularly in learners who have been conditioned to view all learning as being procedural or, in other words, just following directions. A great deal of instruction is procedural in nature, and that is not necessarily a bad thing. But if this type of instruction is the only kind learners experience, they have very few opportunities to develop metacognitive skills. Why would learners need to reflect upon the strategy they choose for a task if the task is presented as if it can be completed in only one way?

When students have multiple opportunities to take ownership of and control over their learning, they gain both motivation and need to develop metacognitive learning strategies. Although some may need more explicit instruction than others, metacognition is a skill that can be developed much like any other, through instruction, practice, and application through successive approximations. Although many of these skills can be observed directly, teachers often must infer their presence or absence indirectly, based on the quality of work completed or the behavior a student demonstrates in the learning process. This determination creates a number of challenges because teachers may misinterpret the reasons learners fail to perform well on a task requiring ownership and engagement, looking for defects in content knowledge when the real issue is lack of proficiency with metacognitive strategies.

Learners who are developing metacognitive learning strategies might not track their understanding consistently. For example, they might continue to read words aloud without comprehending them and not realize that this is a problem, or they might use a particular algorithm incorrectly to complete a set of similar mathematical problems without demonstrating awareness that they were making the same mistake repeatedly. Students learning metacognitive skills need regular feedback about how well they are monitoring and evaluating their ability to effectively and efficiently develop and use a wider range of metacognitive strategies.

Self-regulatory Strategies

The overarching purpose of self-regulatory learning strategies is for learners to use metacognitive insights

to guide how they dynamically adjust their approach to learning in ways that enable them to address the learning task at hand efficiently and effectively. Learners use *self-regulatory strategies* when they act on metacognitive insights to regulate their task-specific mindset, their learning behaviors, or their use of task-oriented strategies. Self-regulatory strategies allow learners to function in a more productive and effective fashion. For example, learners who initially perceive a project as too complex for them and beyond their expertise to complete might regulate this mindset in several ways: They might decide they need to allot extra time to completing the project. They may break the project down into manageable parts, then determine which they can master on their own and which will require help. They may conclude that the effort will be worth the results, even if they do not get the highest grade on it or complete all aspects of it successfully.

Effective learners regulate their learning behavior by redirecting their attention when they realize they're distracted or by being more intentional about the best times and best ways to study after noticing that working alone when tired actually slowed their progress. Additionally, effective learners call upon task-oriented techniques such as organizing information topically and thematically rather than relying on a single list that is overwhelming in its complexity and can't be readily processed for meaning.

Successful self-regulating learners draw upon a variety of tactics that generally work well for them as they seek to regulate their mindset, choose effective learning behaviors, and identify the most productive task-oriented techniques. Learners who are less successful at self-regulation are less likely to be aware of alternative approaches. They might have heard of other approaches, but they do not know enough about how to use them strategically to be able to select the best alternative. They rely on trial and error, and thereby never really come to a deep understanding of what works well for them and what doesn't.

Task Oriented Techniques

These techniques are the ways learners interact with content that help them remember, learn, think, and understand. Task-oriented techniques are very specific and can be taught as methods. Some of these techniques are applicable across a range of learning contexts and content areas. For example, using mnemonic devices, songs, or personal connections are ways of remembering very specific and detailed information. They are necessary in cases in which this type of learning is prerequisite to using this specific knowledge for more complex and integrated purposes. Second language, drama, and music often require memorization as a fundamental prerequisite to performing a task. Science and engineering courses also often have a memorization component. Graphic organizers provide a structure that can facilitate the organization of information so that the information can be drawn upon to complete a larger task such as reading several books or articles as a part of an assignment to write a paper critiquing a particular issue and then organizing all relevant information and ideas contained in the source material before settling on the main argument and the supporting details necessary to frame the paper. Other task-oriented techniques are more content or context specific. For example, close reading of a science textbook chapter employs different strategies than close reading of a poem.

Learners who efficiently use task-oriented techniques can do so at an automatic level, which means they are more efficient than their fellow learners at fundamentally grasping an assignment or project. This ability enables them to think more deeply about what they want to do with the information they have memorized or organized. They are more acutely aware of the strengths, limitations, and purpose of each technique they have at their disposal and have some understanding of the contexts in which each technique is most appropriate and effective. Learners who are less successful at using task-oriented techniques tend to rely on a

few techniques in all situations, be less aware of the limitations of the technique they are using, or have not achieved automaticity with the technique they use, which means they end up being much less efficient than peers who have internalized the technique.

The category of learning strategies is complex and comprises not only tactics for interacting with content but also the executive functions that orchestrate the learning process. To understand content knowledge, students use task-oriented techniques that can range in complexity from basic flash cards or graphic organizers to specific types of reading comprehension strategies. However, these techniques are helpful only to the extent that they are used appropriately in and of themselves and in relation to the task. The self-regulatory strategies, which students use to plan their approach and make adjustments, and the metacognitive strategies, which they use to monitor and evaluate their approach to learning, are important and can largely affect the degree to which students acquire content knowledge. For this reason, student performance on assessments and assignments can reflect much more than content-knowledge acquisition; therefore, it may be less fruitful to increase content-knowledge acquisition without first considering the role of a student's learning strategies.

Why Are Learning Strategies Important?

Students' ability to acquire learning strategies and other metacognitive skills can be as important or even more important than the acquisition of specific content knowledge in preparing them for college and careers (Credé & Kuncel, 2008; Farrington et al., 2012; Oswald, Schmitt, Kim, Ramsay, & Gillespie, 2004; Richardson, Abraham, & Bond, 2012; Robbins, et al., 2004; Sedlacek, 1996, 2004; Sternberg, 2012). Research conducted in the Standards for Success project (Conley, 2003) found that entry-level college courses repeated much of the content to which students had already been exposed in their high school college-preparatory courses. The key success factor, according to instructors of these courses, was not how well students recalled the content they were taught in the high school version of the course, but rather their ability to think critically about what they were learning. The key skill instructors identified was the ability to use content in nonroutine and novel ways to address interesting and complex problems and issues inherent in the academic discipline. To do so, students needed to have mastered a range of learning strategies, not just static content knowledge. Instructors contended that even if students did not know all the content knowledge, they could teach them the content, and students would be expected to comprehend it quickly and efficiently. Most assignments then required using content in more complex ways that required metacognitive skills and learning strategies.

Farrington and colleagues offered several evidence-based arguments to support the importance of teaching learning strategies. They conclude that these strategies are malleable, that they can be taught, and that as students improve their use of learning strategies, their course grades improve. Metacognitive and self-regulating behaviors are critical components that help learners analyze new situations to identify which tools are useful and then determine how to best apply them in a new context.

Underdeveloped learning strategies are perhaps most evident at pivotal transition periods such as the middle school years (Fancsali, Jaffe-Walter, & Dessein, 2013) and the transition to from high school to college (Conley, 2014). Successful transition to a postsecondary environment in particular requires that students have prior awareness of the procedures, requirements, and expectations of colleges. Postsecondary environments are far less structured than high schools. This environment demands that learners become more independent, take initiative, demonstrate persistence, show ownership of learning, monitor their success, and possess a willingness to seek help when needed.

School systems that help students develop metacognitive and self-regulatory strategies increase their probability of their success. This ability is particularly important for first-generation college students, students from low-income households, and members of other student populations with disproportionately lower persistence rates in two- or four-year postsecondary programs (Thayer, 2000). Some colleges are beginning to include measures of metacognitive skills in the basket of data used to make admission, placement, and other decisions (Camara & Schmidt, 1999; Conley, 2005; Credé & Kuncel, 2008; Richardson et al., 2012; Sedlacek, 2004; Soares, 2012).

One of the key reasons that metacognitive and self-regulatory strategies are so important is the role they play in any act of near transfer. *Near transfer* occurs when a skill is applied to a task in the same area or one that is very similar. For example, critically reading two different primary history documents or performing the same job for a different company requires transferring skills that are learned in one context to a new, very similar context. Far transfer is much more difficult to achieve. *Far transfer* occurs when content or skills learned in one setting are applied in a new, very different context. For example, students might be asked to read critically a primary history document and a literary poem and then extract meaning from both, or someone might not just change jobs but change careers altogether, thereby requiring the transfer of all knowledge and skills about the workplace to an entirely

new setting (National Research Council, 2012).

Results from a survey of employers in nonprofit and private sector organizations emphasize the importance and value of students developing learning strategies for successful transitions into and out of college (Hart Research Associates, 2013). Of the 318 business owners—, CEOs, presidents, and executives—who responded, 80% recommended colleges place more emphasis on effective communication, orally and in writing; 82% indicated the need for greater emphasis on critical thinking and analytic reasoning skills; 81% stressed the importance of the ability to analyze and solve complex problems; and 72% supported more attention to students' ability to locate, organize, and evaluate information from multiple sources. Moreover, 93% of respondents agreed that demonstrating the ability to think critically, communicate clearly, and solve complex problems is more important than a candidate's undergraduate major, and 90% placed importance on the ability of those they hire to demonstrate the capacity for continued new learning.

Many careers require those employed to stay abreast of current advancements in the field. Increasingly, knowledge and skills are changing so rapidly that employees must master entirely new skill sets beyond what they learned in school if they are to remain productive and relevant (Gettinger & Seibert, 2002). For example, technical advancements in the automotive industry have required yesterday's mechanic to learn to use computer-based diagnostic programs that did not even exist 25 years ago. Mechanics must now be able to access, interpret, and analyze information. They must make informed judgments, note anomalies and exceptions, and determine the most efficient way among several possible methods to complete a repair. These automotive technicians, as they are now known, go back to school regularly and are tested to see if they will receive certification in new areas. All of this learning, formal and on-the job, requires a range of learning skills such as note taking, reading strategies, and memorization and recall.

Software engineers must adapt constantly to changes in technology, software, and business methods. Increasingly, they are expected to function as a member of a team, which requires communication and human-relation skills often not taught in school. They may need to work with designers and marketing and sales staff to understand customer needs, which can be quite challenging to an engineer committed to following the best engineering principles without much respect for customer needs. Progressing in an organization now is limited to those who can demonstrate leadership skills, not just those who have been around the longest. The task-oriented techniques needed to succeed in these roles may differ from the project-specific skills employees may be accustomed to using routinely. Adaptability, flexibility, and the capacity to acquire new skills are attributes that require metacognitive learning strategies.

Feedback from employers to higher education and professional organizations emphasizes the importance of learning strategies for success in careers. The Career Ready Practices section of the Common Career Technical Core (CCTC; National Association of State Directors of Career Technical Education Consortium, 2012, p. 2–3) enumerates the learning strategies that are necessary for career readiness across all programs of study. For example, career-ready students can demonstrate the following skills:

- make connections between abstract concepts with real-world applications;
- [be] discerning in accepting and using new information to make decisions, change practices, or inform strategies;
- use critical thinking to make sense of problems and persevere in solving them;
- take personal ownership of their own educational and career goals; and
- act on a plan to attain these goals.

Just as manufacturing technology in the early 20th

century transformed the labor market from a relatively small number of specialized craftsmen to a large number of less-skilled workers, technology is once again transforming the labor market. This time, the demand is for highly skilled employees who not only know their craft but can rapidly adapt to changing conditions and demands. The manufacturing sector, once viewed as the domain of unskilled labor, now seeks employees with an understanding of physics and chemistry or engineering concepts, skills in computer programming, and the metacognitive and self-regulatory learning strategies needed to apply these concepts and skills when managing computers that direct multimillion dollar machines. In addition to technical and task-oriented skills, employers require the overarching metacognitive and self-regulatory strategies to allow the vast majority of employees to make decisions closer to the locus of production. With more information available to employees, they need to be able to analyze and evaluate the relevance of new knowledge and consciously apply and communicate what they are learning.

The evidence presented here provides some indication that learning strategies are related to academic outcomes, are valued by colleges and employers, and are malleable and can be taught. But the necessity to teach learning strategies goes beyond the relationship to metrics that we value today or the current interests of colleges and employers. Many issues people face today, such as Internet security or the need for conscious thought in navigating many forms of social media, were unanticipated by parents and teachers 30 years ago. What the future holds for students in terms of the problems and decisions they will face in school, work, and life in general is unknown. Helping students' develop ownership of their metacognitive learning strategies can allow them to analyze information, make thoughtful decisions, and monitor and adjust their choices in the multitude of unknown situations they may face. The question no longer is, "Should we develop students' learning strategies?" Today's question is, "How?"

Local and state experiments to add metacognitive learning strategy instruction, programs, and policies are already underway on a limited basis. Some of the innovative changes are organic developments within districts, while others are guided by content area research[2]. The paper now examines some innovative practices and policies at the classroom, school, district, and state levels. Examples are included for illustrative purposes and do not encompass the entirety of changes currently in progress. However, these examples provide insight into the various means by which practitioners, policy makers, and researchers are moving this field forward, and they demonstrate the practicality of incorporating metacognitive learning strategies more systematically and formally.

Before presenting the examples, it is worth noting that although a great deal of research is being conducted in the area of learning strategies, many of the findings do not yet connect directly with the classroom, with a few notable exceptions.[3] This statement should not be surprising. Research is seldom designed to affect practice directly. In fact, it's difficult to design research studies that do. Limitations noted by Farrington and colleagues (2012) include the focus on researcher-specified learning strategies—not necessarily those that teachers or students would have chosen on their own—and the lack of studies examining potential differential effects of strategies on different populations of students. Additionally, educators often teach learning strategies indirectly or in ways that are not easily observed or that are limited to subgroups of students. Researchers are not necessarily well equipped to recommend effective policies without attending to and examining current practice, and they are not always the best interpreters of current practice. Therefore, although the research informs practice, often the field moves ahead on its own. The following examples help illustrate both the results of research and the independent actions of educators to address what they have come to identify as a crucial problem: the lack of student mastery and use of metacognitive learning strategies.

2 A recent example is the Stanford History Education Groups' focus on historical thinking skills and a way to understand history content.

3 The work of Carol Dweck on mindsets and Angela Duckworth on grit are two prominent examples of areas in which findings about the effects of metacognitive strategies on learning are moving rapidly into practice.

Instructional Practices

The instructional techniques and programs in this section are well known, have some empirical evidence, or have demonstrated long periods of use. These examples are not intended to establish a gold standard based on experimental research, but rather to illustrate ways that learning strategies can be taught. Three broad categories of instructional practices are examined: *content-based strategies and techniques* typically used to learn discipline specific content, *skill-specific programs* that cultivate a particular skill such as studying or regulating a productive mindset, and *integrated programs* that combine instruction of metacognitive strategies, self-regulatory strategies, and task-oriented techniques.

Table 1 provides a general overview of instructional strategies commonly used to develop metacognitive skills in a number of key areas. The strategies in Table 1 are derived from a model for ownership of learning that emphasizes the relationship among a series of metacognitive skills. The model begins with student motivation and engagement as fundamental to successful ownership of learning. High motivation and engagement set the stage for goal setting, whereby the learner establishes how to act upon motivations toward a tangible outcome. Goal orientation facilitates self-direction, which increases learner confidence, thereby setting the stage for greater self-efficacy—the ability of the learner to discern the elements of the learning process under the learner's control. With this control of the learning process, a learner can self-monitor and reflect metacognitively upon the effectiveness of the

learning strategies being used to overcome any barriers in achieving identified learning goals. When the goal is challenging or not easily achieved, the learner then is able to demonstrate persistence by employing a range of strategies and techniques and not giving up when success does not come immediately.

All these learning skills combine to create a resilient learner who can manage the learning process effectively and take on progressively larger challenges that stretch him or her to achieve at new and higher levels. Figure 2 demonstrates the relationship among the elements described in Table 1.

Content-based Strategies and Techniques

Fostering students' use of learning strategies is not new. Many teachers implicitly develop student learning-strategies, without knowing the meaning of terms such as noncognitive skills or metacognition.

Figure 2. Ownership of Learning Model That Supports Use of Metacognitive Skills

Table 1. Instructional Strategies for Improving Students' Learning Skills

Learning Skill	Classroom-level Strategies

Motivation & engagement	• Provide students with opportunities for active learning:
	  • Use project-based learning and formative assessments that allow students to demonstrate learning gains over time.
	  • Provide students with opportunities to collaborate with their peers.
	  • Give students learning options and allow them to make choices and decisions.
	• Provide clear and consistent expectations for student assignments and classroom behavior.
	• Help students make connections between what they are learning and their lives outside of school to help students understand why they should value learning.
	• Balance the difficulty level of assignments and provide scaffolding so that students are challenged but not frustrated.
	• Ensure that students feel supported by listening, asking questions, showing empathy, and providing encouragement.

Goal orientation & self-direction	• Use goal-setting as a central organizer to engage students:
	  • Create ways for students to set long-, medium-, and short-term mastery goals that state what students are going to learn or do, by when, and how they will measure success.
	  • Encourage students to link learning goals to larger educational and life goals.
	  • Display progress toward goal achievement graphically, along with goals achieved.
	• Encourage students to set specific, challenging goals, rather than easy, do-your-best goals.
	• Emphasize the importance and the relevance of new course content to students to help them make the connection between content and their goals.
	• Promote self-direction through challenging, novel, and rewarding assignments.

Self-efficacy & self-confidence	• Help students develop a true sense of accomplishment by assigning challenging work and setting high standards and substantive feedback.
	• Use project-based learning techniques that provide options for students to demonstrate their learning gains in ways that fit each student's learning style.
	• Use formative assessment strategies designed to encourage the notion that students can learn from their mistakes and not be defeated by them:
	  • When students master a concept, praise them using past attributional feedback: "I can see you've been working hard!"
	  • When students fail at a task, encourage them to try again using different strategies and with support if need.
	• Explicitly teach specific learning techniques needed to complete tasks and assignments efficiently and effectively.

Metacognition & self-monitoring	• Teach students metacognitive strategies such as self-assessment and self-reflection:
	  • Teach these strategies in small groups.
	  • Start in early grades and continue to teach these strategies to students in higher grades.
	  • Implement programs over long periods of time.
	• Encourage students to monitor their progress in meeting their goals and to consider adjustments along the way.
	• Teach students how to use learning techniques while they are learning content.
	• Recognize students in instances when they exhibit behavior that reflects metacognitive thought, such as self-corrections or self-initiated descriptions about their learning.
	• Teach students how to monitor the use of learning techniques through self-evaluation and peer feedback.

Persistence	• Help students be successful when they engage in so-called productive struggle. • Allow students to grapple with challenging academic problems to build self-efficacy and a growth mindset rather than giving them the answer right away or jumping in to help too quickly. • Encourage the use of new strategies when students run into a problem they can't solve quickly with a known strategy. • Help students learn to identify when they are stuck and how they can get unstuck. • Demonstrate how to select the most appropriate learning technique for the given task.

For example, an effective teacher can elicit student thoughts for them to connect what they are learning to their own lives or to prime and enhance acquisition of new or related content. Many teachers are familiar with the notion of *activating prior knowledge* as a way to begin a lesson and engage students in a metacognitive dimension of learning. Additionally, teachers regularly foster student self-regulation by providing opportunities for goal setting, action plan development, or success-indicator identification. Instructional practices such as these help create opportunities for students to use learning strategies, but they do not identify self-reflection or goal setting as learning strategies. Nor do these instructional practices substitute for explicit instruction in the use of these strategies. Here, *explicit instruction* means identifying or naming a learning strategy, modeling the strategy, and describing or discussing what it is, how it is used, and why it is helpful. Some teachers use a combination of implicit and explicit instructional practices, particularly for teaching content-based strategies and techniques. Examples of implicit and explicit instructional approaches, including but not limited to those provided in Table 1, cultivate not only student use of learning strategies but also their ownership and independent application of those strategies.

Explicit instruction does not necessarily inhibit opportunities for students to cultivate their own personalized learning strategies or of students taking ownership of their strategies when they identify helpful strategies on their own. For example, within the first three phases of the Biological Science Curriculum Study (BSCS) 5E Instructional Model (Bybee et al., 2006), students engage in a progression of purposefully selected activities. The initial engagement is designed to raise curiosity and indirectly elicit their prior knowledge. The following exploration phase is designed to facilitate airing and correcting of learner misconceptions related to the target concept, process, or skill. The explanation phase explicitly teaches the concept, process, or skill. Intentional opportunities such as these help learners to recognize, identify, and discuss learning strategies, to use them consciously and intentionally, and to think about the best times and places to employ such strategies.

Explicit instruction in learning strategies is beneficial not only for content-knowledge acquisition (Hattie, 2009); it can facilitate transfer of skills to other domains when developed to an advanced level within a single domain (Donovan et al., 1999). For example, primary-level teachers often provide explicit instruction of task-oriented techniques for decoding, such as breaking words into familiar word parts, and comprehending, in the form of summarizing or using context clues. Additionally, teachers might explicitly stress metacognitive learning strategies, such as monitoring one's understanding, and self-regulated learning strategies, such as stopping to re-read. Learning strategies facilitate reading comprehension in any area, but subject-specific reading and writing instruction also is necessary. This instruction encourages students to read and write more like subject-area experts (Biancarosa & Snow, 2006).

The Reading Like a Historian curriculum developed by the Stanford History Education Group (SHEG) (Reisman, 2012) exemplifies explicit instruction of task-oriented techniques for comprehending discipline-specific content—in this case, primary historical documents. The curriculum defines four critical reading skills—sourcing, contextualizing, corroborating, and close reading—used by historians to investigate historical questions through analysis of primary documents. The curriculum identifies and develops these specific skills as the keys to historical thinking and the path though which students understand history content, although they are broadly transferrable to many subject areas.

The curriculum supports explicit instruction of the four historical thinking techniques through classroom posters that define the field of history as well as each historical reading technique. Explicit instruction is the focal point of cognitive apprenticeship lessons, one of

the four lesson structures built within the curriculum (Reisman, 2012). Through cognitive apprenticeship, the teacher models a reading skill used in the study of history and then provides students opportunities to practice the skill with support that eventually allows students to take ownership of the skill and apply it independently. This lesson structure also enables teachers to clarify what the technique involves and how and when it could best be used in relation a specific discipline, history in this case.

By focusing on learning strategies as vehicles for understanding content, the SHEG was able to develop short-answer formative assessments that measure content and learning strategies. Students apply a specified analytic technique in combination with historical knowledge contained in a primary source document to answer the assessment question. Teachers can use results from these assessments to guide their conversations with individual students, monitor development of learning strategies class-wide, and direct their lesson planning. The SHEG's innovative curriculum design illustrates explicit instruction in specific task-oriented learning techniques, but it is less explicit in teaching the metacognitive and self-regulatory strategies supporting these task-oriented techniques.

The Project Lead the Way curriculum teaches students task-oriented techniques for comprehending science, engineering, and mathematics concepts though a project-based approach (Project Lead the Way, Inc., 2013). The curriculum framework for each kindergarten though fifth grade, middle school, and high school module specifies the relevant processes used by professionals, the skills and knowledge student should acquire, and the skills students should be able to transfer beyond the module activities.

For example, after completing the fifth grade module on robotics and automation, students should understand that engineers use a design process that involves solving a problem through a step-by-step approach. Students should know what knowledge is necessary at each step to solve the problem, follow the step-by-step approach when solving the problem, and apply that process independently (Project Lead the Way, 2013). These steps require a combination of content knowledge and metacognitive skills. Students use a professional process to set up the problem, draw from content knowledge deliberately and purposively, apply a specific learning skill to complete the process, and learn to transfer these skills to dissimilar problems and situations in the sciences and beyond. Performance rubrics and reflective questions are used throughout the course for formative and summative assessment purposes. These assessment techniques help engage students' metacognitive learning strategies. By designing project-based curriculum around both science, technology, engineering, and mathematics (STEM) content *and* skills, students engage in inquiry as a systematic process that requires applying scientific thought and strategies in a conscious manner.

Explicit instruction in learning strategies can occur without an externally designed curriculum. Teachers can incorporate opportunities into individual lessons using processes similar to those employed in teaching reading comprehension, historical thinking strategies, and thinking techniques of the scientific method (see Biancarosa & Snow, 2006; Project Lead the Way Inc., 2014; Reisman, 2012). For example, teachers can use the Understanding by Design Framework to create lessons that incorporate metacognitive strategies within any instructional setting (Wiggins & McTighe, 2013). This framework uses a backward design approach based on three steps. First, teachers identify desired outcomes by examining content standards and establishing long-term performance goals for transfer, meaning making, and acquisition of skills and knowledge. Second, they determine what assessment evidence is needed to document if the learning targets are met. Third, teachers plan the most appropriate lessons and activities to address the established performance goals. Identifying the transfer, knowledge, and skill goals as the first step

ensures that the subsequent curriculum decisions support student development of learning strategies and content-knowledge acquisition.

The Cognitive Academic Language Learning Approach (CALLA, Chamot & O'Malley, 1994, 2009) guides the incorporation of learning strategies into lesson planning as a way of improving discipline content and skill acquisition for bilingual students' or English-as-a-second-language students' who have a well developed understanding of English. This approach reflects the three broad steps of the Understanding by Design Framework, but it includes language objectives in addition to content and learning strategy objectives. Transfer objectives are not specified, but teachers consider several aspects of lesson procedures, including how they will foster students' transfer of knowledge and skills as part of the expansion aspect of the CALLA lesson-planning approach. CALLA enhances transfer by specifying four metacognitive strategies and four categories of task-based strategies to teach across discipline areas.

The Socratic seminar is an example of an approach in which teachers generate activities designed to engage students in deeper thought by collectively discussing, questioning, and analyzing text or video (Tredway, 1995). Unlike debates aimed at uncovering or establishing the correct or best answer, Socratic seminars are organized around open-ended questions that invite students to share their understanding, points of confusion, interpretations, reflections, and additional questions. In successful Socratic seminars, the thoughts aired by peers collectively foster higher-order thought that enhances every student's learning experience.

This approach requires more than selecting an engaging document, identifying initial discussion questions, and setting aside time for students to talk. Successful Socratic seminars expect students to understand communication norms and the types of thinking and questioning that moves conversation forward. For example, a student's statement of what they liked about the text, without any knowledge of why that aspect resonated or was intriguing, limits the utility of that comment for both that student and the rest of the group. Students benefit when they are taught to establish their participation goals, provide evidence for their interpretive statements, actively incorporate others in dialogue, summarize what others have said, connect ideas to their own lives, and monitor and reflect on the discussion, their contribution, and the evolution of their understanding. Calling out the learning strategies and discussion processes involved is particularly important given that the ultimate goal is for students to take ownership of these skills and engage in conversation without relying on the teacher's cues.

As content-area researchers learn more about the defining skills of the disciplines, their findings could open the door to the development of more practitioner resources for teaching learning skills in the context of the discipline. These resources take the form of instructional models, planning tools, and curriculum and intervention materials to support explicit instruction in learning strategies. Explicit instruction in task-oriented techniques within content areas is becoming more common. However, with the exception of developments in reading instruction and immersion or second-language learning, explicit instruction of metacognitive and self-regulatory learning strategies within subject areas has not been implemented to the same extent.

Skill-specific Programs

A multitude of programs, trainings, and resource materials help students develop specific skills such as note taking or test preparation that are not content-area specific. Many postsecondary institutions have Teaching and Learning Centers or Career or Academic Resource Centers dedicated to teach students a variety of learning techniques, including how to establish effective study groups, manage their time, set goals, and manage test anxiety. Course

offerings have expanded during several decades in response to an increased number of students entering college unprepared for the workload and self-direction required. For this reason, these programs sometimes are viewed as supports for struggling students, but all students can benefit from using these programs to enhance their metacognitive learning strategies.

Available resources can also enhance students' use of metacognitive learning strategies in preparation for their postsecondary transition. Kaplan and The Princeton Review specialize in preparing students for particular tests. However, some high schools are turning to companies that can provide ACT and SAT preparation courses for an entire class or multiple classes of students. This development provides opportunities to students who might not otherwise have access to paid courses; they now can acquire test-taking strategies that may help them to learn more efficiently in all subject areas.

Additionally, guides such as Pauk and Owens' How to Study in College (2005) describe specific learning strategies and techniques that improve test-taking skills, goal-setting, self-management, and many other key skills relevant for postsecondary learning, whether in college or in a career. For example, the guide describes Cornell Notes, an organized system for documenting, retrieving, and understanding information. A designated place for a topic or a problem question frames the notes and can serve as a marker to keep a collection of notes organized. The columns for headings, vocabulary, key words, and essential questions highlight the critical elements of the topic and can guide students' approaches to studying in a more efficient and focused manner. By completing a summary section after note taking, students engage in self-reflective processes that could enhance understanding of the content. Cornell Notes is just one of many possible strategies for taking notes described by Pauk and Owens (2005).

Another key skill area is the ability to study effectively. Gall and colleagues (1990) define study skills in a manner akin to definitions of metacognitive learning strategies as the *effective use of appropriate techniques for completing a learning task*. The authors lay out the considerations and steps needed to incorporate learning strategies instruction within a school, including the choice between separate courses or infusing instruction throughout all classes. Instructional programs that are built around strategies and techniques instead of content provide explicit instruction on task-oriented techniques such as structuring notes to aid learning or regulating a student's mindset. However, in this approach, content knowledge is the subject to which strategies are applied. Consequently, these instructional programs might not demonstrate how the strategy works in different content areas, which may limit students' transfer of strategies beyond the context in which they were taught.

Other skills-specific strategies target the self-regulatory processes. Student use of learning strategies may be influenced by their mindset, specifically their view of the degree to which their abilities are fixed or fluid (Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2006; Farrington et al., 2012). Educators use a suite of professional development resources organized into a growth-mindset curriculum to help foster student self-regulation of their mindset and more productive use of learning strategies. Mindset could also play a role in students' grit—their perseverance and passion for long-term goals—which could influence their postsecondary plans (Duckworth, Peterson, Matthews, & Kelly, 2007; Tough, 2012).

Grit does not require students to first undergo adversity to succeed, but it can play a role in whether people successfully navigate the challenges that arise in any long-term commitment (Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014). Professional achievement has also been linked with grit, as the factor that allows people to persistently apply their talent over time (Duckworth, Peterson, Matthews, & Kelly, 2007). For these reasons, grit is defined here as persistence, a

trait that anyone can develop whether or not he or she has overcome adversity. The Duckworth Lab provides several grit scales and measures that could be used by students, teachers, or administrators for self-assessment purposes (Duckworth & Quinn, 2009; University of Pennsylvania, 2014).

Integrated Approaches

Cross-disciplinary metacognitive learning strategies can be developed within the context of a specific discipline as well. Two similar approaches to assessment—ThinkReady from the Educational Policy Improvement Center (Conley & Young, 2012; ThinkReady, 2013) and the Deeper Learning Student Assessment System from the Stanford Center for Assessment, Learning, and Equity (SCALE, 2014)—allow students to develop cognitive strategies while demonstrating their content knowledge by completing performance tasks. Research indicates that these assessments help focus instruction on higher-order skills, are more accurate at measuring students' abilities, engage students deeply in learning, and generate results that can improve instruction (Wood, Darling-Hammond, Neill, & Roschewski, 2008).

A benefit of performance assessment systems is that they provide teachers with a reference point for how to change their instruction. When a group of 20 schools in New York City implemented ThinkReady, evidence indicated that teachers began to change their instructional practices in ways that led to greater emphasis on developing a range of metacognitive learning skills in students while they still prepared students for state exams (Conley & Young, 2012). The development of work products over periods of as long as two weeks required students to use a much wider range of learning skills. The skills developed by ThinkReady derive from the Four Keys model and include hypothesizing, strategizing, identifying and collecting resources, analyzing and synthesizing information to reach conclusions, organizing and constructing products appropriate to the intended audience and purpose, and demonstrating precision and accuracy consistent with the rules of the academic discipline within which the task was situated.

The Carnegie Foundation for the Advancement of Teaching has sponsored two programs designed to take the place of remedial mathematics instruction. Statway and Quantway are aimed at improving the mathematics skills of college students through the development of productive persistence. Silva & White (2013) found that after the first year of Statway, 51% of students who took that course transitioned into credit-bearing mathematics courses, as compared with 6% of students prior to the intervention. After one term of Quantway, 56% of students transitioned successfully out of developmental mathematics into credit-bearing courses compared with 21% of students on the same campuses who did not take the Quantway course. These courses were developed through partnerships between researchers and college faculty who attempted to address explicitly metacognitive learning factors that faculty identified as being important for students struggling to complete developmental mathematics courses. These students believed in their potential as mathematics students, set goals, asked questions, and persisted though challenges or failure while building relationships with classmates (Silva & White, 2013). The Carnegie Foundation report (Silva & White, 2013) further refined those factors into a productive persistence model describing five drivers or contributors to student success:

- Students need to:
  - possess skills, habits, and know-how to succeed in a college setting;
  - be socially tied to peers, faculty and the course;
  - believe the course has value; and
  - believe they are capable of learning mathematics.
- Faculty and college need to support students' skills and mindsets.

Each of these five drivers was paired with interventions called change ideas that sought to establish the mindsets for learning that students need to be successful, including their self-efficacy, the value they placed on learning materials, and their personal connections on campus.

Another well recognized program that helps students develop learning strategies is Advancement Via Individual Determination (AVID). This program combines training for school and district leaders, professional development for educators, elective courses and tutoring for students, and workshops for parents designed to create a college-going culture. AVID targets students who may be working below their potential and who might benefit from a targeted intervention of the type AVID offers (Guthrie & Guthrie, 2002).

The AVID program is built around what it calls the *WICOR model*, which stands for Writing, Inquiry, Collaboration, Organization, and Reading. It's clear that the program emphasizes academic and learning skills in equal measure. AVID training helps teachers learn how to help students use specific techniques such as the Cornell Notes, deeper reading and writing strategies, and graphic organizers to increase their efficiency in understanding discipline-specific content (AVID, n.d.). AVID explicitly teaches broader organizational strategies for project planning and goal setting. AVID teachers use instructional practices that engage deeper learning, including Socratic seminars and Philosophical Chairs, a technique that requires students to take a stance on a statement related to a selected text. Students then indicate whether they agree with the statement, disagree, or are undecided by sitting in respectively designated chairs on the right, left, or back of a horseshoe-shaped seating arrangement. Opportunities to change their stance—and, consequently where they sit—following discussion engages students in metacognitive and self-reflective thought. Each course has daily learning logs that also utilize these self-reflective practices.

The International Baccalaureate (IB) Diploma Programme encompasses a series of courses during the final two years of high school that help students gain a grasp various academic disciplines and the structure of knowledge in them as well. These courses provide a broader array of learning experiences that encourage deeper learning and development of metacognitive learning strategies. In addition to the more familiar Diploma Programme, IB offers the Primary Years Programme, the Middle Years Programme, and the recently implemented IB Career-related Certificate for high school students.

The overall goal of IB is to develop learners who not only are knowledgeable but who are caring, principled, open-minded, and reflective adults and citizens who inquire, think, communicate, reflect, take risks, and live a balanced life (International Baccalaureate Organization, 2013). The expectation is that students will use metacognitive and self-regulatory strategies to approach complex problems critically and creatively, recognize and be thoughtful in considering their learning and experience, and examine their strengths and limitations to support their learning and growth.

Self-reflective thought is the central focus of Theory of Knowledge courses within the IB Diploma Programme. The primary purpose of the course is to engage student in discussion and self-reflection about how they know what they claim to know. The course culminates with students writing a paper and giving presentation that demonstrates their mastery of these ways of knowing and of thinking. Additionally, the Extended Essay program requires students to analyze, synthesize, and evaluate knowledge by engaging in an in-depth research study that mirrors undergraduate research requirements.

All three of these programs teach self-regulation of mindsets. All are open to and have demonstrated success with groups of students who traditionally are less successful in postsecondary schooling (Coca et al., 2012; Van Campen, Sowers, & Strother, 2013).

These programs operate under the philosophy that students from underrepresented groups need specific instruction in the learning skills they will need to succeed in college. They provide real-world case studies of the need for metacognitive skill development and the effects of doing so in a targeted fashion.

As an alterative to adopting an established program, some schools have developed their own integrated approach to cultivate students' use of cross-disciplinary metacognitive learning strategies within each discipline. The local changes in the Danville Independent School District in Kentucky are among a growing number of examples. In 2012, the Danville Independent School District took an unconventional approach to district-wide reform by establishing the Danville Diploma, a document outlining district requirements and specific experiences the district seeks to provide for all of its students. The first item on the Diploma is a set of 11 skills with which the district commits to equip its students. Several of these skills reflect a commitment to teaching learning strategies, including the following:

- discover how critical thinking skills are used across disciplines;
- adapt and problem solve;
- manage time and create a plan for accomplishing a task or goal;
- know how to find reliable and accurate information; and
- analyze, synthesize, and make inferences from data.

What sets the Danville Diploma apart is its commitment to integrate its 11 skills into the district's comprehensive instructional program. The Danville Diploma is a living document that influences and shapes practice in each classroom. At the beginning of each lesson, teachers are expected to identify a learning target skill from the Danville Diploma, and that skill is in addition to the content standards taught in the lesson. Teachers then connect the learning targets to students' interests, and they reference the targets throughout each lesson. Students are expected to understand, identify, and use the learning targets to complete their lessons. Formative assessments help students gauge how well they are using learning skills to achieve lesson outcomes. Additionally, students collect evidence demonstrating progress toward the meeting the Danville Diploma competencies. Danville was recognized as a Kentucky District of Innovation in 2013. This designation grants them flexibility with certain state requirements, which further helps the district continue its experiment in which teachers are teaching learning skills on par with content standards.

Helping all students develop metacognitive learning strategies requires teaching *for* thinking, teaching *of* thinking, and teaching *about* thinking (Costa, 1985; Brandt, 1984). Common instructional practice today includes teaching *for* teaching, structuring the classroom environment, lessons, and interactions with students in a manner that implicitly engages their thinking, reflection, and self-regulation. Teachers teach *of* thinking as they take advantage of advancements within content-area research to teach discipline thinking skills. Outside integrated school programs such as IB and AVID, instruction of cross-disciplinary strategies such as study skills and note taking, and efforts to teach *about* thinking, the development of metacognitive skills predominately remains isolated from instruction within subject areas.

Instructional programs that focus on specific skills such as note-taking may deepen student learning, but adopting multiple programs to teach skill-specific techniques, metacognition, and self-regulation is infeasible for schools and districts and fails to foster transfer across disciplines and other contexts. With the exception of AVID and IB programs, few schools and fewer districts provide explicit instruction in skill-specific strategies across content areas. Moreover, the AVID and IB programs currently serve a relatively small number of students and likely aren't scalable

enough to close the skills gap on their own in all schools, districts, and states anytime soon.

State-Level Policies and Assessments

States are in a difficult position when it comes to recognizing the importance and significance of metacognitive learning skills and techniques as important methods to improve student readiness for college, careers, and life beyond high school. Even though all states have academic-content standards, few incorporate metacognitive skills or learning strategies. This situation is in part the legacy of the first standards-development period of the early 1990s, known initially as outcome-based education. These early standards contained many statements about student learning and thinking skills. They often went beyond these learning-related skills to include mention of what many considered to be character-related standards. Some people objected to schools developing student character because this trait was considered to be the exclusive domain of the family. As a result, many state and most national standards-development efforts assiduously avoided any standard that went beyond specifying content knowledge or thinking processes closely associated with content knowledge.

Two notable exceptions to this trend were Standards for Success (Conley, 2003) and the Texas College and Career Readiness Standards (TCCRS; Texas Higher Education Coordinating Board & Texas Education Agency, 2009). Standards for Success was the first set of national standards to specify the expectations of instructors at leading U. S. universities. Those expectations strongly emphasized student mastery of key cognitive strategies and learning skills and techniques. The standards themselves implied strong competency for students as thinkers and learners. The TCCRS, developed by cross-sector teams comprising secondary and postsecondary educators, included a section that enumerated a set of cross-disciplinary skills critical to being a successful learner in college. These two sets of standards were, for the most part, exceptions to a national trend that saw states and content organizations focus narrowly on explicit content knowledge in their standards documents.

Some evidence exists that states are tentatively moving beyond content-only expectations for learners. A few states have diploma requirements that include learning skills in addition to mastery of English language and mathematics. A number have adopted definitions of college and career readiness that incorporate metacognitive learning skills and related learning behaviors. Others are implementing a wider range of assessments, including some that gauge learning skills as elements of their federally approved waivers from the No Child Left Behind Act requirements.

This tentative exploration and embrace of educational goals and expectations that go beyond content-knowledge mastery is a tacit acknowledgement that content standards alone are not enough to prepare all students for the future. They are recognition that many students will not have the opportunity to learn these skills anywhere other than school, even as a privileged few have ample opportunities to do so in a wide range of settings outside of formal education.

The theory of action during the past two decades has been that states would specify desired educational outcomes, tests would measure them in a reliable and valid fashion, and school districts and schools would be free to design locally the instructional programs that best enabled students to master the specified content knowledge. The assumption was that teachers would use a range of strategies and techniques, carefully adapted to the needs of local student populations, so that all students would reach desired performance levels. Initially, states measured the range of outcomes for multiple subject areas. Over time and due to the influence of federal education policy, the focus has narrowed to English language and mathematics content knowledge, so much so that schools have lost sight almost entirely of the learning processes required to master content in these important foundational areas.

Although states witnessed improvements on content-knowledge measures, largely at the elementary level, during this period of time, the improvement has been painfully slow, erratic, and difficult to sustain. Significant improvement in high school test scores has been particularly elusive. Some states have begun to consider the possibility that simply specifying outcomes and remaining entirely agnostic about learning skills and techniques may be insufficient. These outlier states have started to pay more attention to the process of learning in addition to the outcomes and to reaffirm the value of having students develop a range of specific strategies and tools for managing the learning process and coping with challenging content.

In particular, states have begun to adopt formal definitions of a college- and career-ready student. These definitions go beyond content knowledge to include other key skills and dispositions. Many are variations on the Four Keys model (Conley, 2014), with additions based on state preferences and emphases. All include some reference to content knowledge, and most reference critical thinking skills and problem solving. A few go further and incorporate learning skills as well. For example, Hawaii's P-20 Council recently adopted a definition that is largely based on the Four Keys model, including Essential Content Knowledge, Transitional Skills, Learning Skills, and Cognitive Strategies, which combines elements from the Key Cognitive Strategies and Key Learning Skills and Techniques, and an additional dimension of Wayfinding, translating an indigenous concept of how students navigate the world, relate to their community, and understand their cultural identity (Hawai'i, 2013). Hawaii's definition also includes an explicit reference to learning strategies such as using specific learning methods such as goal-setting, persistence, and self-awareness as well as time management and organization, study skills, technology skills, and collaborative learning.

Other state definitions articulate many of the key components of college readiness through a different framework. The Wisconsin Department of Public Instruction defined college and career readiness as requiring knowledge; skills such as creativity and innovation, written and oral communication, and life and career skills; and habits and behaviors such as flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility, and health and wellness (Wisconsin Department of Public Instruction, 2013, p. 362).

Likewise, the Maine Learning Results describe what K–12 students should know and be able to do in eight content areas; they include self-directed and lifelong learner as one of the five interdisciplinary Guiding Principles (Maine Department of Education, 2007). This type of learner recognizes the need for information and locates and evaluates resources; applies knowledge to set goals and make informed decisions; applies knowledge in new contexts; demonstrates initiative and independence; demonstrates flexibility, including the ability to learn, unlearn, and relearn; and demonstrates reliability and concern for quality (Maine Department of Education, 2007, p. 2). All these attributes of college and career readiness require the use of metacognitive learning strategies, especially those that refer to situations in which monitoring and transfer of knowledge and skills are required such as self-directed learning and unlearning and relearning information.

In 2009, the Oregon State Board of Education adopted new diploma requirements. Students were expected to demonstrate proficiency in a number of Essential Skills, including traditional areas such as reading, writing, and mathematics. However, these Essential Skills also specified more complex outcomes, including the ability to think critically and analytically, to use technology in a variety of contexts, to demonstrate civic and community engagement, to demonstrate global literacy, and to demonstrate personal management and teamwork skills (Oregon Department of Education, 2010).

The reading, writing, and mathematics requirements overlap significantly with the Common Core State Standards, and they expect students to be able to summarize and analyze texts; distinguish fact from inference; develop well-reasoned, well-supported arguments; and write in a variety of genres for a range of purposes. The listening and speaking skills include the ability to provide directions clearly, to present and discuss ideas, and to adapt language based on the audience and the purpose. Achieving these skills will require students to have a wider set of learning skills than simply reciting lessons from rote or following directions in a procedural fashion.

The remaining five Essential Skills more explicitly require a wider range of learning skills and techniques. For students to think critically and analytically, they must be able to develop methods and techniques for analyzing information and evaluating conflicting points of view. Technology use is a learning skill in and of itself. Performing civic and community responsibilities requires integrated behavior sets and skills that go far beyond academic-content knowledge. Global literacy is achieved only by being able to appreciate and value the points of view of others as well as to understand their cultural beliefs and norms within a broader framework in which no culture is absolutely right or wrong. Finally, personal management and teamwork skills are the most explicit examples of metacognitive learning skills.

The Common Core State Standards themselves imply that students have mastered a wide range of metacognitive learning strategies. Here are examples of some Common Core standards that suggest the need for a sophisticated set of learning skills and techniques:

- Conduct research and synthesize information.
- Develop and evaluate claims.
- Read critically and analyze complex texts.
- Communicate ideas through writing, speaking, and responding.
- Plan, evaluate, and refine solution strategies.
- Design and use mathematical models.
- Explain, justify, and critique mathematical reasoning.

These standards require that students do more than follow directions or use one approach for all learning tasks. To conduct research and synthesize information, learners must have good organizational skills to collect and categorize information. They need to be able to manage their time to complete a task that cannot be performed well in one sitting or the night before it is due. Communicating ideas in a variety of modes necessitates organizational skills and attention to detail, precision, and accuracy. To plan, evaluate, and refine solution strategies, learners need to exercise a range of learning skills, including self-monitoring, metacognition, self-efficacy, and self-direction. To design and use mathematical models, learners must demonstrate persistence, among other skills.

These complex skills are among the most important for success in college courses. A national sample of 1,815 college instructors across a wide range of content areas (for example, English language arts [ELA], mathematics, science, social science business management, computer technology, and health care) were asked to rate both the ELA and literacy standards and the mathematics standards in terms of their applicability to the course and its importance, if the standard was applicable (Conley, Drummond, de Gonzalez, Rooseboom, & Stout, 2011). College instructors reported ELA Common Core standards with higher levels of scope and breadth to be the most applicable and important for their course. Such standards include those that reference mastering comprehension of nonfiction text at a grade-appropriate level, extracting key ideas and details, and using research to support written analysis. Similarly, the mathematics standards with the highest ratings of applicability and importance included reasoning quantitatively, interpreting functions, and those that emphasized problem

solving, analytic thinking, or other thinking skills. To prepare students for postsecondary education, they need to develop complex skills that require more than memorizing and reciting content.

In short, the Common Core State Standards will increase the urgency in classrooms across the country for all learners to have the opportunity to learn a wide range of metacognitive learning strategies. Those who do lack this opportunity may well learn the basic content of the Common Core without gaining the deeper insights and understandings the Common Core was designed to deliver to all students.

Students who have not had the opportunity to develop metacognitive skills will be challenged to do well on the tests of the Common Core being developed by consortia of states. These assessments hold some promise for validating the importance of a wider range of metacognitive learning skills and techniques. The Smarter Balanced Assessment Consortium and the Partnership for Assessment of College and Careers [PARCC] have created assessments that value problem solving to a greater degree and expect students to master material at a deeper level to be able to make more decisions about problem solving. The tests have item types that cannot be answered by selecting a response from among several prompts. They also have performance tasks and writing tests that require students to apply a wider range of strategies to complete them successfully. The formative assessment activities designed to support these assessments will be more cognitively complex in nature than the average teacher's current type of assignment, and they will challenge students to engage at a deeper cognitive level throughout a more sustained period of time. They will require more learning management skills.

Several states have decided to move beyond the consortia assessments as sole measures of student success to include a range of additional indicators. For example, the Kentucky Performance Rating for Educational Progress (K-PREP) includes both criterion-referenced items written to the Kentucky Core Academic Standards (KCAS), which incorporate the Common Core State Standards, as well as norm-referenced items from the Stanford 10 to allow comparisons of student performance nationwide (Kentucky Department of Education, 2013). These content-area assessments use traditional multiple-choice items types as well as short-answer and extended-response items that require students to select answers and demonstrate their thinking, which provides greater insight into their mastery of content knowledge *and* learning strategies. K-PREP includes On-Demand Writing items for Grades 5, 6, 8, 10, and 11 that assess skills specified in the Common Core State Standards while providing an indication of students' organizational and planning strategy development.

In addition to end-of-course assessments required in high school, students in 8th, 10th, and 11th grades take ACT's EXPLORE, PLAN, and ACT assessments for college and career readiness (Kentucky Department of Education, 2014). Students who do not meet ACT benchmarks can take the Kentucky Online Testing placement tests that measure students' preparedness for college entry-level courses in mathematics, reading, and writing, thus allowing all students to have some indication of their degree of preparation for postsecondary transition.

New Hampshire is in the process of developing common statewide performance tasks that will be included within a comprehensive state assessment system along with Smarter Balanced Assessment Consortium (SBAC) assessments. Each performance task will be a complex, curriculum-embedded assignment involving multiple steps that require students to use metacognitive learning skills. As a result, student performance will reflect the depth of what students have learned and their ability to apply that learning.

The tasks will be based on college- and career-ready

competencies across major academic disciplines, including the Common Core State Standards–aligned competencies for English language arts and literacy and mathematics, as well as New Hampshire's K–12 Model Science Competencies recently approved by the New Hampshire Board of Education (New Hampshire Department of Education, 2014). Performance tasks will be developed for elementary, middle, and high school grade spans and will not replace local course-level competencies. Instead, they will establish a common metric for student learning across the state that supplements SBAC by testing students' ability to apply learning strategies to complex tasks.

ACT's WorkKeys is an example of an assessment used by many states to certify career readiness. Designed to appeal to students who may be pursuing a two-year certificate or going directly into the workforce, the tests acknowledge the importance of applying content knowledge in real-world settings and the necessary thinking skills. WorkKeys incorporates and values learning skills in addition to content knowledge. For example, the applied mathematics assessment targets reasoning skills needed to analyze implicit information and solve a work-related problem, translate information into mathematical expressions, and plan and navigate the necessary logical steps and calculations. The assessment assumes students have access to a calculator and provides all the formulas necessary to complete the tasks; as a result, it focuses primarily on students' approach, which requires cognitive and metacognitive skills.

Students who take and pass three WorkKeys assessments receive the National Career Readiness Certificate, which recognizes their skills in problem solving, critical thinking, and the application of reading, mathematics, and interpretive reasoning in work-related contexts. The certificate is awarded at one of four levels: Bronze, Silver, Gold, or Platinum, depending on the student's test scores. The NCRC Plus (ACT, Inc., 2014) also ranks students on a one- to four-star scale on the following workplace-defined soft skills:

- Discipline: Productivity and dependability
- Teamwork: Tolerance, communication, and attitude
- Customer service orientation: Interpersonal skills and perseverance
- Managerial potential: Persuasion, enthusiasm, and problem solving

Multi-state Collaborative Efforts

Collaboration between states could propel changes in state policy toward systems of assessment that better support learner acquisition and use of learning strategies. The Innovation Lab Network (ILN) is a multistate consortium organized and sponsored by the Council of Chief State School Officers. The ILN comprises nine states committed to working together to transform their education systems in a manner that prepares students for postsecondary education, the workforce, and citizenship. The ILN states have established a shared framework and definition of college, career, and citizenship readiness that each ILN state will adopt (Council of Chief State School Officers, 2013). The ILN college- and career-ready definition encompasses knowledge, skills, and dispositional components such as agency, initiative, resilience, adaptability, leadership, ethical behavior and civic responsibility, social awareness and empathy, and self-control (Council of Chief State School Officers, 2013).

The Center for Innovation in Education (CIE) at the University of Kentucky is working with educators from multiple states in the ILN and beyond to develop instruments that will describe and measure metacognitive learning skills along a developmental progression. CIE has organized a Skills and Dispositions Working Group composed of state, district, and school leaders to build off of the ILN work by constructing novice-to-expert frameworks for a prioritized set of skills and dispositions, including self-directed learning skills. After the frameworks are developed, they can inform the creation of observational tools, assessments, and

student self-reflection surveys that will better measure these skills and dispositions systematically over time in a way that captures learner development longitudinally as well as at a point in time.

Innovation zones offer one possible mechanism for promoting experimentation with instruments that measure metacognitive learning in a relatively safe, low-stakes environment. Some state innovation policies include financial awards and public recognition. Others emphasize collaboration between schools and districts. Some focus on specific forms of innovation, in this case, metacognitive tools and strategies.

Voluntary experimentation of this nature, such as illustrated by the Danville Independent School District example, creates the opportunity for educators and policymakers to see what is possible. The risk is that small, localized innovations will never be rigorously evaluated or broadly implemented. Innovation zones can be valuable to the districts that participate in them without necessarily benefiting the state as a whole, unless the state commits beforehand to using the results from such experiments and then reports the existence and purpose of the innovation zone activities to all educators statewide.

Possible State Reactions and Actions

States have always been the primary incubators of educational policy in the United States. Even major federal policies, such as the No Child Left Behind (NCLB) Act, can be traced back to state policy initiatives such as reforms in Texas in the 1990s among others, in the case of NCLB. The climate for state experiments with metacognitive learning skills may become increasingly receptive as the limits of content-knowledge measures in English and mathematics are reached. The implementation of SBAC and PARCC in the next few years will raise this matter to the level of a critical policy issue. Most states will experience drops in the proportion of students who are designated as meeting the standard when compared with their previous tests. These results will trigger examination of the best strategies to improve scores.

The natural response will be to intensify what is already being done; in other words, more English and mathematics instruction. Some policy makers and educators may, however, begin to reach the conclusion that more is not necessarily better. They may be more open to exploring improvements in student learning skills and techniques as the gateway strategy to increase test scores.

The other force operating to encourage greater innovation and experimentation in a limited way is the U. S. Department of Education's waiver policy. As noted, the Core Districts in California are experimenting for the first time with a wider array of measures to demonstrate student growth. Other states have taken some tentative steps toward incorporating more and varied assessment results into diploma requirements and state accountability systems, as noted previously. With the proper encouragement, support, and access to quality prototypes and models, those states and their school districts may be more open to incorporating metacognitive techniques and measures into their schools and their accountability systems.

Now is the time to take advantage of this nascent acknowledgement that the current quasi-obsessive focus on a narrow set of content knowledge—to the exclusion of all other knowledge and skills—is never going to enable all students to be successful 21st century citizens.

Action Recommendations

1. *Continue and intensify research about metacognitive learning skills and techniques to validate their legitimacy as contributing factors to student achievement and lifelong learning.*

The research already conducted in the private sector shows a great deal about the importance of metacognitive learning skills to success in the workforce and as a member of society. By drawing on and adding to this work, educators can build a case for moving beyond the 1920s theories of intelligence and learning that underlie the current content-assessment models.

Understanding the current state of learning strategy instruction would be a sizable and much needed contribution. Additionally, examining the relationship between practitioner approaches to teaching learning strategies and student outcomes could expose differential relationships across various student populations. A primary role of research in general is uncovering inequities in practice and providing support for addressing them (Learning First Alliance & Knowledge Alliance, 2010). However, to find them requires that practitioners establish data-collection policies and practices that enable research to work.

2. *Initiate projects to develop more and better instruments to gauge these skills.*

Researchers can inform the construction of district or state data systems in a way that makes data analysis and feedback from researchers more feasible. Collaboration between practitioners and researchers could support the development of instruments that provide valid scores and are useful and attainable in the classroom.

3. *Encourage states and districts to integrate metacognitive measures into state systems of assessment in appropriate ways.*

At the state level, examine low-stakes inclusion of metacognitive measure in public reporting and accountability systems or as components of a cumulative accountability score. Encourage school districts to incorporate measures of metacognitive learning skills into teacher grading systems and into low-stakes, formative longitudinal data systems designed to help students track their own progress and development as learners. Identify districts or schools willing to take the lead as proof-of-concept sites that demonstrate the feasibility of reporting this sort of information in addition to traditional grades and state reading and mathematics tests.

4. *Help colleges learn how to use this information and develop data systems that enable the capture and transfer to postsecondary education information on a range of learning skills.*

Not all information on student learning skills needs to be used for high-stakes decisions, but knowing more about how students manage the learning process is particularly important as they become more independent learners in postsecondary settings. Insight into their metacognitive skills can be useful to the students, advisors, and others whose job it is to support entering students. The data need not be used to deny admission or relegate students to remedial education courses; instead, this type of information should be used to gain insight into what a student can do, rather than what they cannot do.

5. *Consider what it will take to train teachers to use these skills in the classroom.*

Training may take place in a number of ways: in the context of content knowledge being taught so that students learn how to think in ways that experts in a subject area do; separately, but consciously and explicitly, integrated into subject matter and across subject areas; and in comprehensive programs of instruction that build upon metacognitive learning skills through the content taught and the assignments and assessments that learners complete.

Concluding Thoughts

The notion of incorporating metacognitive learning skills, strategies, and techniques into schooling in a formal, explicit, and purposive fashion may not be an entirely new or novel idea, but it is one whose time may have come. The economy and society of the 21st century has already shown itself to be one that demands competent, adaptive learners who can drive their own learning processes. Although content knowledge is clearly important, the new expectations for learners is that they will be able to use content knowledge in novel, non-routine ways and to acquire necessary information on their own as needed. They will be expected to understand how experts in a field of study think and go about solving problems. They will need to be able to manage themselves, their time, and their personal organization to complete more complex and demanding learning tasks. They will need to be able to set goals, monitor their progress toward achieving those goals, reflect on their effectiveness, and persist when they encounter tasks or challenges that demand more than a one-and-done approach.

Developing and incorporating these types of skills into schooling will be challenging in an environment in which content standards in English and mathematics dominate, where content tests in these areas have been elevated to the level of absolute measures of student competence, where instructional methods have focused more on content acquisition than interesting or authentic applications and uses of content knowledge, and where the notion that each learner needs to develop a wide range of skills and strategies is less widely accepted.

Another facet of the challenge is the reality that many students develop these metacognitive skills through a range of enrichment activities or special attention from adults. Some students are encouraged to do something inventive or daring such as entering a science fair; forming and participating on a team for events such as Odyssey of the Mind; spending summers full of trips, internships, museums, and special programs; participating in honors courses, talented and gifted programs, and having any range of experiences that emphasize development of metacognition and personal ownership of learning. All these students have an advantage over those whose school year and summer consist of routine and uninspiring tasks that require little involvement or ownership. These less fortunate learners are largely alienated from the school's instructional program and participate more on a compliance basis than anything else. School asks little of them, and they offer little in return. In the bargain, they behave themselves and do what they're told for the most part.

In other cases, students participate fully and get good grades, but the instruction to which they are exposed does not give them the opportunity to own their learning, nor do the learning tasks require metacognitive skills. However, these students are under the impression, based on their grades, that they are fully prepared for a range of futures. They often encounter severe frustration and give up when they discover when entering a postsecondary program that the education they received did not prepare them for the demands of learning tasks and situations in which their ability to think, take charge, and select among a range of strategies would be paramount for their success.

Metacognitive learning skills, strategies, and techniques offer possibilities to energize teaching and make learning more engaging in ways that are consistent with evidence from brain and cognitive studies (Dweck & Reppucci, 1973; Grant & Dweck, 2003; Greene & Miller, 1996; Ramsden et al., 2011). They also open the door to a range of educational experiences that are not entertained when the only legitimate and valued form of learning is content-knowledge acquisition that can be demonstrated on standardized tests.

These metacognitive skills have not received nearly as much attention as decontextualized content-knowledge instruction and testing. However, thoughtful development of and commitment to new models of instruction and assessment—and, in some cases

to older, well-tested approaches—can enable more classrooms to become environments within which all students have opportunities to be learners controlling their own learning and exercising an array of means, methods, and approaches that fall under the category of metacognitive skills, strategies, and techniques.

This paper highlights the conceptual soundness of explicitly acknowledging and developing metacognitive dimensions in the learning process. It also demonstrates the feasibility of measuring these skills and of the ways in which schools, districts, and states can incorporate them into practice, first on a limited, experimental basis, with the commitment to scaling them up when they demonstrate success.

A commitment to the systematic development and validation of metacognitive tools, techniques, and methods will help U.S. schools excel to an even greater degree at the one thing they already do better than any other schools in the world: getting students to think creatively, deeply, and independently about complex, nonroutine problems and applications of knowledge. Currently, not all U.S. students have the same access to learning opportunities that develop their thinking and metacognitive skills. Making America's schools truly great requires extending to all U.S. students the opportunities that the best and brightest have used to become world-class thinkers and learners who are as capable and motivated to reach the highest levels of performance as any students in the world.

References

ACT, Inc. (2014). ACT National Career Readiness Certificate: About the Certificate. Retrieved from http://www.act.org/certificate/about.html

AVID (n.d.). WICOR: AVID's Foundation for High Engagement Teaching & Learning. Retrieved from http://www.avid.org/dl/hed/hed_reviewofliterature.pdf

Biancarosa, G., & Snow, C. E. (2006). Reading next—A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York (2nd ed.). Washington, DC: Alliance for Excellent Education.

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S., (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. Child Development, 78(1), 246–263.

Brandt, R. (September 1984). Teaching of thinking, for thinking, about thinking. Educational Leadership, 42(1), 3.

Bybee, R. W., Taylor, J. A., Bardner, A., Van Scotter, P., Powell, C., Westbrook, A., & Landes, N. (2006). The BSCS 5E Instructional model: Origins and effectiveness. Colorado Springs, CO: BSCS—Biological Sciences Curriculum Study.

Camara, W. J., & Schmidt, A. E. (1999). Group differences in standardized testing and social stratification (Report No. 99-5). New York: College Entrance Examination Board.

Chamot, A. U., & O'Malley, J. M., (1994). The CALLA handbook: Implementing the cognitive academic language learning approach. White Plains, NY: Addison Wesley Longman.

Chamot, A. U., & O'Malley, J. M., (2009). The CALLA handbook: Implementing the cognitive academic language learning approach (2nd ed.). Upper Saddle River, NJ: Pearson Education ESL.

Coca, V., Johnson, D., Kelley-Kemple, T., Roderick, M., Moeller, E., Williams, N., & Moragne, K., (2012). Working to my potential: The postsecondary experiences of CPS students in the International Baccalaureate Diploma Programme. Chicago: University of Chicago Consortium on Chicago School Research.

Conley, D. T. (2003). Understanding university success. Eugene, OR: Center for Educational Policy Research, University of Oregon.

Conley, D. T. (2005). Proficiency-based admissions. In W. J. Camara & E. Kimmell (Eds.), Choosing students: Higher education admissions tools for the 21st Century (pp. 313–330). Mahwah, NJ: Lawrence Erlbaum.

Conley, D. T. (January 22, 2013). Rethinking the notion of "noncognitive." Education Week, 32(18), 20–21.

Conley, D.T. (2014). Getting ready for college, careers, and the Common Core: What every educator needs to know. San Francisco, CA: Jossey-Bass.

Conley, D.T., Drummond, K.V., de Gonzalez, A., Rooseboom, J., & Stout, O. (2011). Reaching the goal: The applicability and importance of the Common Core State Standards to College and Career Readiness. Eugene, OR: Educational Policy Improvement Center.

Conley, D. T., & French, E. M. (2014). Student ownership of learning as a key component of college readiness. American Behavioral Scientist, 58(8), 1018–1034.

Conley, D., & Young, B. (2012). Final progress report: College-readiness performance assessment system (C-PAS). Eugene, OR: Educational Policy Improvement Center.

Costa, A. (1985). Developing Minds: A Resource Book for Teaching Thinking. Alexandria, VA: ASCD.

References

Council of Chief State School Officers. (February 2013). Knowledge, skills, and dispositions: The innovation lab network state framework for college, career, and citizenship readiness, and implications for state policy. Retrieved from http://www.ccsso.org/Resources/Publications/ILN_CCR_Framework.html

Credé, M., & Kuncel, N. R. (2008). Study habits, skills, and attitudes: The third pillar supporting collegiate academic performance. Perspectives on Psychological Science, 3, 425–453.

Donovan, M. S., Bransford, J. D., & Pellegrino, J. W., Eds. (1999). How people learn: Bridging research and practice. Washington DC: National Academy Press.)

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: Perseverance and passion for long-term goals. Journal of Personality and Social Psychology, 9, 1087–1101.

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (Grit-S). Journal of Personality Assessment, 91(2), 166–174.

Dweck, C. (2006). Mindset: The new psychology of success. New York: Random House, Inc.

Dweck, C. S., & Reppucci, N. D. (1973). Learned helplessness and reinforcement responsibility in children. Journal of Personality and Social Psychology, 25, 109–116.

Eskreis-Winkler, L., Shulman, E., Beal, S., & Duckworth, A.L. (2014). The grit effect: Predicting retention in the military, the workplace, school and marriage. Frontiers in Personality Science and Individual Differences, 5(36), 1–12.

Fancsali, C., Jaffe-Walter, R., & Dessein, L. (October 2013). Student agency practices in the middle shift learning networks. Columbia, MA: IMPAQ International, LLC.

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Seneca Keyes, T., Johnson, D. W., & Beechum, N. O. (2012). Teaching adolescents to become learners. The role of noncognitive factors in shaping school performance: A critical literature review. Chicago: University of Chicago Consortium on Chicago School Research.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. American Psychologist, 34(10), 906–911.

Gall, M. D., Gall, J. P., Jacobsen, D. R., & Bullock, T. L. (1990). Tools for learning: A guide to teaching study skills. Alexandria, VA: Association for Supervision and Curriculum Development.

Gettinger, M., & Seibert, J. K. (2002). Contributions of study skills to academic competence. School Psychology Review, 31(3), 350–365.

Grant, H. & Dweck, C.S. (2003). Clarifying achievement goals and their impact. Journal of Personality and Social Psychology, 85(3), 541-553.

Greene, B.A. & Miller, R.B. (1996). Influences on achievement: Goals, perceived ability, and cognitive engagement. Contemporary Educational Psychology, 21, 181–192.

Guthrie, L. F. & Guthrie, G. P. (2002). The magnificent eight: AVID best practices study. Burlingame, CA: Center for Research, Evaluation, and Training in Education. Retrieved from http://www.avid.org/dl/res_research/ research_magnificenteight.pdf

Hart Research Associates. (2013). It takes more than a major: Employers priorities for college learning and student success. Washington, DC. Retrieved from http://www.aacu.org/leap/documents/2013_EmployerSurvey.pdf

Hattie, J. (2009). Visible learning: A Synthesis of over 800 meta-analyses relating to achievement. New York, NY: Taylor & Francis.

Hawai'i P-20 Partnership for Education. (September 2013). Definition of college, career, and community readiness in Hawai'i. Retrieved from http://www.p20hawaii.org/ wp-content/uploads/2013/06/CCCR_Definition_Handout_6.pdf

Heckman, J. J., & Rubinstein, Y. (2001). The importance of noncognitive skills: Lessons from the GED testing program. American Economic Review, 91(2), 145–149.

International Baccalaureate Organization. (2013). Theory of knowledge guide, first assessment 2015. Wales, UK.

Kentucky Department of Education. (2013). Kentucky performance rating for educational progress. Retrieved from http://education.ky.gov/AA/KTS/Pages/Technical-Manuals.aspx

Kentucky Department of Education. (2014). KYOTE. Retrieved from http://education.ky.gov/AA/distsupp/Pages/KYOTE.aspx

Learning First Alliance & Knowledge Alliance/Center for Knowledge Use. (2010). Using Evidence for a Change: Challenges for Research, Innovation & Improvement in Education. Retrieved from: http://www.learningfirst.org/sites/default/ files/assets/UsingEvidenceforaChangeFinalReport.pdf

Maine Department of Education (2007). Chapter 132—Learning results: Parameters for essential instruction. Retrieved from http://www.maine.gov/education/lres/pei/ch132-2007.pdf

National Association of State Directors for Career Technical Education Consortium/National Career Technical Education Foundation. (2012). Common career technical core. Silver Spring, MD.

National Research Council. (2012). Education for life and work: developing transferable knowledge and skills in the 21st century. Committee on Defining Deeper Learning and 21st Century Skills. J. W. Pellegrino and M. L. Hilton, Eds. Board on Testing and Assessment on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

New Hampshire Department of Education. (2014). Course-level and statewide competencies. Retrieved from http://www.education.nh.gov/innovations/hs_redesign/competencies.htm

O'Malley J. M. & Chamot, A. U. (1990). Learning strategies in second language acquisition. New York, NY: Cambridge University Press.

Oregon Department of Education. (2010). Appendix L—Requirements for assessment of essential skills. Retrieved from http://www.ode.state.or.us/wma/teachlearn/testing/admin/2010-11-appendix_l.pdf

Oswald, F. L., Schmitt, N., Kim, B. H., Ramsay, L. J., & Gillespie, M. A. (2004). Developing a biodata measure and situational judgment inventory as predictors of college student performance. Journal of Applied Psychology, 89(2), 187–207.

Pauk, W., & Owens, R. J. Q. (2005). How to study in college. Boston: MA, Houghton Mifflin Company.

Pintrich, P. R., Smith, D. A. F., Garcia, T., McKeachie, W. J., (1993). Reliability and predictive validity of the Motivated Strategies for Learning Questionnaire (Mslq). Educational and Psychological Measurement, 53(3), 801–813.

Project Lead the Way, Inc. (2013). Curriculum framework robotics and automation: Challenge 2013–14 Retrieved from https://www.pltw.org/sites/default/

vfiles/2013-14 Section 5.2 Curriculum Framework_RA2_03 06 2014.pdf

Project Lead the Way, Inc. (2014). Our approach. Retrieved from https://www.pltw.org/about-us/our-approach

Raikes Foundation. (2013). The middle shift. Retrieved from http://raikesfoundation.org/ Documents/Raikes%20Foundation%20Middle%20Shift%20Initiative%20Overview.pdf

Ramsden, S., Richardson, F.M., Josse, G., Thomas, M.S.C., Ellis, C., Shakeshaft, C., Seghier, M.L. & Price, C.L. (2011). Verbal and non-verbal intelligence changes in the teenage brain. Nature, 479, 113-116.

Reisman, A. (2012). Reading like a historian: A document-based history curriculum intervention in urban high schools. Cognition and Instruction, 30(1), 86–112.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: A systematic review and meta-analysis. Psychological Bulletin, 138, 353–387.

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R., & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. Psychological Bulletin, 130, 261–288.

Sedlacek, W. E. (1996). Employing noncognitive variables in admitting students of color. New Directions for Student Services, 74, 79–91.

Sedlacek, W. E. (2004). Beyond the big test: Noncognitive assessment in higher education. San Francisco, CA: Jossey-Bass.

Silva, E., & White, T. (2013). Pathways to improvement: Using psychological strategies to help college students master developmental math. Stanford, CA: The Carnegie Foundation for the Advancement of Teaching.

Soares, J. A. (2012). The future of college admissions: Discussion. Educational Psychologist, 47(1), 66–70.

Stanford Center for Assessment, Learning and Equity. (2014). Envision education deeper student learning assessment initiative. Retrieved at https://scale.stanford.edu/ content/envision-education-deeper-student-learning-assessment-initiative

Sternberg, R. J. (2012). Assessing hidden talents. In College Admissions for the 21st Century (pp. 1–13). Cambridge, MA: Harvard University Press.

Texas Higher Education Coordinating Board & Texas Education Agency. (2009). Texas College and Career Readiness Standards. Retrieved from http://www.thecb.state.tx.us/collegereadiness/crs.pdf

Thayer, P. B. (2000). Retention of students from first generation and low income backgrounds. Opportunity Outlook, 1–9.

ThinkReady [Assessment]. (2013). Eugene: OR University of Oregon and CCR Consulting, LLC.

Tough, P. (2012). How children succeed: Grit, curiosity, and the hidden power of character. New York, NY: Houghton Mifflin Harcourt Publishing Company.

Tredway, L. (1995). Socratic seminars: Engaging students in intellectual discourse. Educational Leadership, 53(1), 26–29.

University of Pennsylvania. (2014). The Duckworth Lab, research. Retrieved from https://sites.sas.upenn.edu/duckworth/pages/research

Van Campen, J., Sowers, N., & Strother, S., (2013). Community college pathways: 2012–2013 Descriptive report. Stanford, CA: Carnegie Foundation.

Weinstein, C. E., & Mayer, R. E. (1986). The teaching of learning strategies. Handbook of Research on Reaching, 3, 315–327.

Wiggins, G., & McTighe, J. (2013). Understanding by design. Alexandria, VA: Association for Supervision and Curriculum Development.

The William and Flora Hewlett Foundation. (April 2013). Deeper learning competencies. Retrieved from http://www.hewlett.org/uploads/documents/Deeper_Learning_Defined__April_2013.pdf

Wisconsin Department of Public Instruction (2013). Wisconsin ESEA flexibility request. Retrieved from http://esea.dpi.wi.gov/files/esea/pdf/waiver-final.pdf

Wood, G. H., Darling-Hammond, L., Neill, M., & Roschewski, P. (2008). Refocusing accountability: Using local performance assessments to enhance teaching and learning for higher order skills. Briefing paper prepared for members of the Congress of the United States. Stewart, OH: Forum for Education and Democracy. Retrieved from http://www.fairtest.org/sites/default/files/PerformanceAssessments.pdf

Zimmerman, B. J. (2002). Becoming a self-regulated learner. Theory into Practice, 41(2), 64–70.

Publication prepared by the Educational Policy Improvement Center (EPIC)

1700 Millrace Drive, Eugene OR 97403
111 SW Fifth Avenue, Suite 2100, Portland OR 97204

www.epiconline.org