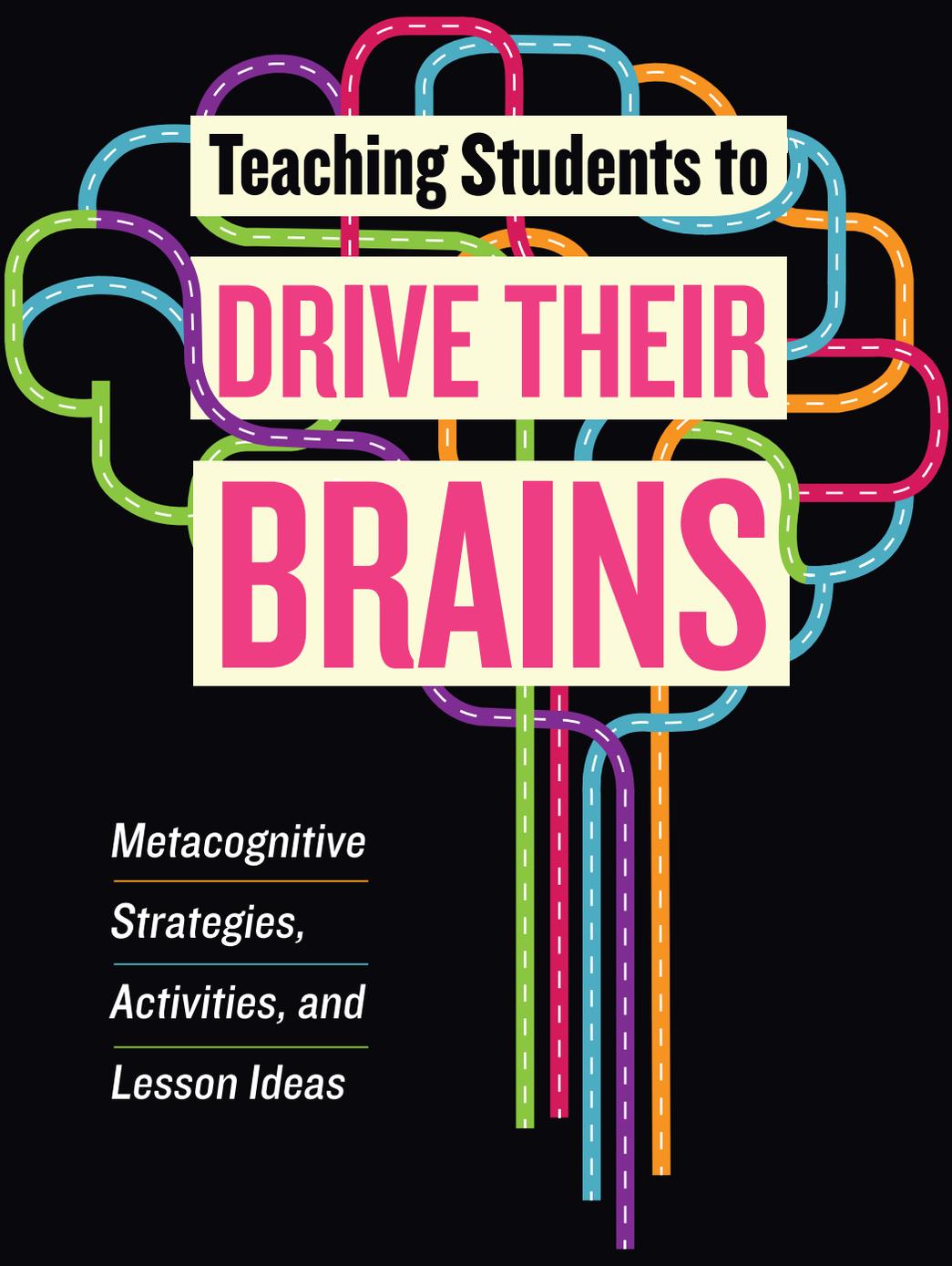


**Donna Wilson**

**Marcus Conyers**



**Teaching Students to**

**DRIVE THEIR**

**BRAINS**

*Metacognitive  
Strategies,  
Activities, and  
Lesson Ideas*

# Teaching Students to Drive Their Brains: Metacognitive Strategies, Activities, and Lesson Ideas

Preface .....	viii
Introduction to Metacognition .....	1
Chapter 1      The Case for Teaching <i>for</i> and <i>with</i> Metacognition .....	7
Chapter 2      Metacognition and the Learning Brain .....	24
Chapter 3      Practical Optimism to Improve Motivation and Productivity .....	41
Chapter 4      Goal Setting and Planning for Learning.....	54
Chapter 5      Selective Attention and Working Memory.....	71
Chapter 6      Strategies for Self-Monitoring and Learning with Peers .....	89
Chapter 7      Start and Finish Strong with Metacognition.....	108
References .....	122
About the Authors .....	129
Index.....	131

# Preface

---

I'd like to share my professional journey to discover the importance of teaching metacognitive and cognitive skills. I began my career in education as a classroom teacher—eager, enthusiastic, and equipped with the subject matter knowledge and classroom management techniques I learned while earning my undergraduate degree. However, I lacked an understanding of how students learn and how I might teach in ways that would increase their ability to learn. I became a student again in search of those answers. I studied the work of influential educational researchers and theorists including Robert Sternberg's understanding of intelligence as practical, creative, and analytic; and Reuven Feuerstein's applications of structural cognitive modifiability, the concept that students can become functionally smarter. Later, I had the privilege to engage in post-doctoral study at the late Dr. Feuerstein's institute, the International Center for the Enhancement of Learning Potential in Jerusalem. I found the work of Russian neuropsychologist Alexander Luria equally fascinating. Alongside colleague Sally Church, I began to integrate principles about the brain and school neuropsychology into my work with students who had learning challenges.

After becoming a school psychologist, I returned to the same district, where I worked with 1,000 students to conduct diagnostic

assessments, many of which indicated that these struggling students were capable of learning at higher levels but had not been taught the skills and strategies they needed. Acting on these findings, I returned to the classroom, this time coteaching with 2nd grade teachers to provide explicit instruction on strategies students could use to think about their thinking and improve their learning (Wilson, 1996a, 1996b). The positive effect of those lessons on students' academic performance led me to the next phase of my career, pursuing teacher education as a way to share practical applications of the "science of learning" with others. This work has been professionally rewarding, in part because it has given me the opportunity to help fill a gap in teacher education—by applying fascinating research in psychology, neuroscience, and education to provide many practical tools for teaching that support the ways students learn.

A key focus of Marcus's work over the last 35 years in 30 countries has been on cultivating the metacognitive and cognitive skills that drive academic and career performance. He has worked with a broad range of corporate, military, and government organizations, including agencies involved in counterintelligence, law enforcement, and fire and rescue services, as well as college and university students and K–12 educators and administrators. Marcus has presented to audiences around the world, including ministers of education from Ontario, Canada; South Africa; and the United Arab Emirates.

Marcus's professional passion has been for empowering educators with research-based frameworks and strategies for teaching students to become effective thinkers and problem solvers. To this end, he developed the original BrainSMART model for aligning teaching with the science of learning by working with 1,200 K–12 students and tens of thousands of teachers and administrators. He led a three-year initiative with this model for the Florida Department of Education and another with Florida DOE supported by an Annenberg Challenge Grant. The positive results

from these initiatives led to our partnership codeveloping curriculum for graduate degree programs with Nova Southeastern University and writing a series of books on applications of mind, brain, and education science.

For the last 16 years, Marcus and I have been on a mission to disseminate the implications of mind, brain, and education research for classroom practice through the publication of books like this one, in conference presentations and live professional development with more than 160,000 educators, in the online educational community, and in the graduate studies we codeveloped with Nova Southeastern University. Teachers and administrators who have studied with us in those programs speak enthusiastically about the difference this approach has made for their students and for their own professional practice. One teacher noted that explicit instruction on using metacognition has allowed her students to manage their own learning: “If students know what they know and still need to learn and what strategies they need to use [to support their learning], they are much more likely to be successful at school.”

In 2001, we introduced the brain-based teaching degree programs at Nova Southeastern University and since then have shared in the excitement of teachers who are energized by the learning gains of students taught to wield metacognitive and cognitive strategies and to become, in the words of one student, “the boss of my brain.” We are pleased to share some of the success stories from their classrooms as practical examples of metacognition in action.

—Donna Wilson

# Introduction to Metacognition

---

What do we want for children and teenagers today? What do they need to succeed in school, in their future careers, and in the pursuit of their dreams? Wherever their ambitions lead them, they will benefit from becoming creative problem solvers, analytical thinkers, and effective communicators and collaborators. Guiding students to recognize that they can learn these vital skills and improve them provides a pathway to achieve the goals they set for themselves. Some of the most vital and versatile skillsets we can teach students to develop are the abilities to think about their learning; to be aware of factors that affect their intellectual performance; to know how, when, where, and why to use particular cognitive strategies; and to monitor and adjust their performance of learning tasks.

These abilities fall under the umbrella of *metacognition*, which refers to knowledge about and regulation of one's thinking. At the core of being metacognitive is taking a step back and **F1** observing one's thinking, as depicted in Figure 1, which is sometimes called the *reflective process*. Questions that might be asked during this process include: What is the problem to be solved? What should I do? How am I doing? How well did I do? What can I do differently and better next time?

FIGURE 1

### The Reflective Process of Metacognition



©2016 BrainSMART, Inc. Adapted by permission. All rights reserved.

Teaching students to become more metacognitive equips them with skills to “drive their brains” and become self-directed learners. As in driver’s education, students need explicit instruction on how to steer their thinking, when they need to slow down and when it’s OK to speed up, where they might take shortcuts to get to their learning goals, and when they might benefit from a leisurely road trip along the back roads of knowledge. Many teenagers yearn for their driver’s license, but developing the abilities and mindset to take charge of their learning will take them further in life than the keys to any car. And students don’t have to wait until their teenage years to take “brain-driving lessons.” They can and should start learning about metacognition at an early age and apply it across all core subjects and in life lessons.

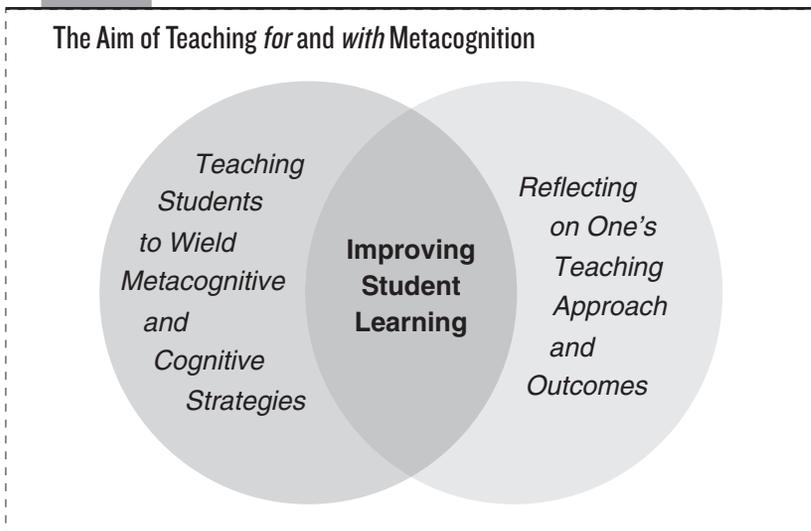
## Innovative Approach to Teaching Metacognition

This text offers a practitioner-friendly guide for teachers who want to teach both *with* metacognition and *for* metacognition. Teaching for metacognition involves guiding students to become self-reflective, self-directed learners who understand why, how, when, and where to use metacognitive and cognitive strategies; teaching with metacognition entails reflecting on one's teaching approach and the outcomes of classroom practice. Improving student learning is at the center of both goals (see Figure 2).

F2

In contrast to books on this subject that are written primarily for researchers, we take the practical perspective of educators who want to know how the research applies to the everyday tasks of teaching—formulating goals, planning and implementing lessons and activities, self-monitoring while teaching, and learning from experience, with the continual goal of increasing instructional effectiveness. Knowing how important it is for their students to

FIGURE 2



©2016 BrainSMART, Inc. Used by permission. All rights reserved.

become metacognitive across contexts, teachers will also appreciate the concrete strategies offered here to teach *for* metacognition throughout the school year.

A second key difference is that our approach is based on our work with teachers during the last two decades. At the core of our framework is an understanding of cognitive assets as “workhorses of the mind,” with metacognition as the overseer of that learning horsepower. For example, think about how crucial it is for students to use the cognitive asset of selective attention when working on an important learning task. Teaching students to be metacognitive about directing their attention goes well beyond reminders to “Pay attention!” Students benefit from explicit instruction on how to focus their attention, on monitoring how well they are applying this asset, and on practicing the use of selective attention across contexts in the classroom and in their personal lives. Metacognition and related cognitive skills are only helpful when they are used appropriately.

Third, this text relates “big ideas” in education (Wilson & Conyers, 2013a) to the importance of metacognition in teaching and learning. We explain the amazing potential of the human brain through new understandings about neural plasticity—in particular, experience-dependent synaptogenesis and dynamic, malleable intelligence. We tie together how deploying the cognitive assets when and how they are needed with metacognition helps students achieve more of their learning potential and become self-regulated, independent, and self-directed learners. This approach connects emerging neuroscience to metacognition in learning.

Fourth, we present metaphors that are beloved by teachers who use this approach—including the idea of students driving their brains—to make the complex concept of metacognition easier to understand and apply. We suggest a variety of metaphors and step-by-step suggestions to illustrate the applications of metacognition and cognitive assets in classroom learning, in students’ lives outside of school, and in their future educational and career pursuits. We share our own stories and real-life examples

from teachers about using these tools and the improvement seen in students' learning.

Throughout this book, we will explore extensive research on how academic achievement is affected when explicit instruction is provided on why, how, and when to use metacognition and cognitive strategies. This research forms the foundation for practical teaching strategies and classroom applications presented in each chapter:

- The sections on teaching with metacognition and specific cognitive strategies in mind offer a concrete approach to planning and delivering lessons in ways that encourage and support self-directed learning. Many of the ideas presented in these sections can be applied across core subjects.
- The sample lessons begin with recommendations on introducing students to the use of the cognitive strategies showcased in each chapter and then lead into an assortment of learning activities for specified grade levels and subject matters. The “extenders” suggest adjustments for younger or older students.
- The Metacognition Checkpoint boxes feature a short list of questions on how students can think more productively about employing the cognitive assets.
- Each chapter concludes with a discussion of how teachers can incorporate the featured cognitive asset into their professional practice, so that they are teaching *with* metacognition as well as *for* metacognition.

Many teachers have told us their classrooms have become more positive, even joyful, as students more often experience those “aha!” moments of learning that come from thinking about their thinking. In addition, educators report that teaching with metacognition has helped transform their classroom practice and attitude about their profession. As one teacher put it, “My students now have a teacher who has the strategies and tools to help them learn to think metacognitively and to teach the ‘how’ to become successful in school and in their personal lives.” The what, why, and how of metacognition is the focus of Chapter 1.



---

# The Case for Teaching *for* and *with* Metacognition

---

Metacognition is an essential, but often neglected, component of a 21st century education that teaches students *how* to learn. From preschool through high school, the instructional schedule is packed with content lessons with little time for guiding students in developing the metacognitive and cognitive skills that can help them excel in the classroom and in the working world. Although the curriculum and professional development may cover instruction on cognitive strategies, the daily schedule may not provide the explicit teaching and intensive practice students need to learn how, when, where, and why to use these strategies effectively. The assumption seems to be either that children arrive at school naturally equipped with the ability to learn or that they will pick up these skills on their own in the course of learning how to read, write, and do math, science, and social studies—or not. Extending this assumption, students who do not develop thinking and learning abilities on their own are often dismissed as having limited learning potential.

As the research shows, we now know that metacognitive and cognitive abilities are not naturally endowed but can and should be taught and learned. Furthermore, providing this foundation for students through explicit instruction alongside core subject lessons will help develop their abilities to become self-directed learners who are better able to improve their academic performance across the curriculum and effectively transfer and apply what they have learned. As Dunlosky asserts, “teaching students how to learn is as important as teaching them content, because acquiring both the right learning strategies and background knowledge is important—if not essential—for promoting lifelong learning” (2013, pp. 12–13).

## Defining Metacognition

*Metacognition* involves thinking about one’s thinking, or cognition, with the goal of enhancing learning. Much of the educational theory and research surrounding metacognition is based on the work of developmental psychologist John Flavell, who applied this terminology in describing the management of information processing activities that occur during *cognitive transactions*. “Metacognition refers, among other things, to the active monitoring and consequent regulation and orchestration of these processes . . . usually in service of some concrete goal or objective” (1976, p. 232). More simply put, metacognition involves being knowledgeable about and in control of one’s cognitive abilities:

Metacognitive knowledge includes knowledge about oneself as a learner and the factors that might impact performance, knowledge about strategies, and knowledge about when and why to use strategies. Metacognitive regulation is the monitoring of one’s cognition and includes planning activities, awareness of comprehension and task performance, and evaluation of the efficacy of monitoring processes and strategies. (Lai, 2011, p. 2)

A student uses metacognition when she reads an unfamiliar word and decides to use two strategies she has learned to puzzle out a word's meaning—breaking it down into components and looking for contextual clues. After she checks her guess against the glossary in the textbook, she thinks, “I was fairly close, and this was good practice. I might run across words I don't know when I take the SAT, and I won't be able to look those up.” Another student studying for a test is being metacognitive when he consciously uses several memory strategies and compares them to determine which one seems to work the best for enhancing recall. The goal of teaching students to be metacognitive is to guide them to consciously, and with increasing independence, recognize when and how to employ cognitive strategies that work best for them across various situations.

Hand in hand with teaching metacognition is explicit instruction on the use of these cognitive strategies, or *cognitive assets*. We use the term *assets* to convey that these abilities are extremely valuable and can be enhanced with practice and regular use. Throughout this text, we will present a variety of cognitive assets—specific tools that can be used to complete tasks and to transfer learning across a variety of contexts. Students employ these cognitive assets across core content to

- Maintain an outlook of practical optimism about their learning performance,
- Set learning goals and plan to achieve them,
- Focus their selective attention and optimize working memory,
- Monitor their learning progress, and
- Apply their learning experiences across core subjects and in their personal lives.

Historically, educators focused on the *cognitive deficits* that students bring to learning tasks, which were regarded as relatively fixed and used to explain poor academic performance. By changing

our focus to *cognitive assets*, educators aim to communicate that strategies for improving learning performance can be taught, learned, and improved with practice. Refocusing on strengths rather than deficits leads to a more incremental view of learning, sometimes referred to as a *growth mindset* (Dweck, 2006) and *dynamic intelligence*.

Viewing learning as an incremental process applies to virtually all students, whatever their performance levels. In the United States, instruction in higher-order thinking processes has often been reserved for students identified as gifted. Of course, high-performing students benefit from learning how to wield metacognitive and cognitive strategies—and so do their peers, including students with learning challenges. In fact, teaching struggling learners how, when, and why to use these strategies may help them catch up in academic performance and recognize that they can succeed in achieving learning goals with hard work and persistent effort. After teaching students with moderate to severe disabilities how to use cognitive skills as part of instruction on core subject lessons, California middle school teacher Paul Farmer reported that “the accumulation of small incremental changes over time might result in measurable and meaningful functional outcomes” (personal correspondence, January 10, 2013).

The cognitive assets contain a toolbox of versatile thinking tools that can be taught—but not in isolation from metacognition. Students must learn how to use metacognition to know how and when to use these assets to successfully master learning and problem-solving challenges, both inside and outside the classroom, and to assess how well they are using these strategies. A variety of cognitive assets are presented in the following chapters. Paired with instruction on when and how to use these assets—to apply a metacognitive approach—students can learn to wield powerful tools that can help them in school and life contexts, from taking tests to maintaining healthy and positive relationships with friends and family.

The use of metacognition and cognitive strategies engages two levels of thinking. The first level involves applying a cognitive strategy to solve a problem; the second involves using metacognition to select and monitor the effectiveness of that strategy. Hattie describes metacognition as “higher order thinking, which involves active control over the cognitive process engaged in learning” (2009, p. 188). Teaching students to be metacognitive involves building their knowledge about cognition and their ability to take charge of their brainpower; enhancing their understanding of how, why, and when to use the cognitive assets that are essential in learning how to learn; and assessing how well they are using cognitive assets and what they might do to improve their learning.

Here are several other terms associated with metacognition:

- *Executive function* describes the brain processes and mental faculties involved in goal setting, planning and execution, reasoning, problem solving, working memory, and organization.

- *Higher-order thinking*, sometimes called *critical thinking*, generally refers to going beyond the rote memorization of facts to skills such as analyzing, synthesizing, and transferring knowledge to other applications.

- *Self-regulation* and *self-directed learning* are accomplished by guiding students to recognize that they are in charge of their emotions, thoughts, and actions, and by equipping them with strategies and skills to steer their feelings, thinking, and behaviors in positive and productive directions.

- *Mindfulness* refers to focusing one’s consciousness on current feelings, thoughts, and sensations. By being mindful of their emotional state, for example, teachers and students can more effectively steer their feelings and thoughts in a more positive, “can-do” direction (see Chapter 3).

The center of these cognitive functions in the brain is the prefrontal cortex, located directly behind the forehead. Goldberg describes the prefrontal cortex as the brain’s “chief executive

officer” for its role in “forming goals and objectives and then in devising plans of action required to obtain these goals. It selects the cognitive skills required to complete the plans, coordinates these skills, and applies them in correct order” (2009, p. 23). More recent research (Fleming, 2014) also identifies this area of the brain—specifically the anterior prefrontal cortex—as the center of metacognition.

Executive function, higher-order thinking, and self-regulation can all be improved over time using metacognition. If these cognitive functions and assets perform as musicians in the orchestra of learning, then metacognition is the conductor. The conductor chooses which works to perform, leads the musicians through intensive practice, maintains the tempo, directs various sections to take the lead at times, and reviews the performance to pinpoint where fine-tuning may be needed. In the same way, by developing our metacognitive capacities, we can better direct our attention to the learning task at hand, choose which cognitive assets are needed for the task, monitor our performance, and identify how we might improve our learning.

Because the concepts of metacognition and executive function can seem quite abstract, using phrases like “driving your brain” or identifying metacognition as the conductor of the orchestra of learning can help make these ideas more concrete and practical for students. And it is certainly worth the effort to teach students how they can take charge of their learning and, by monitoring and improving their use of the cognitive assets, make steady gains in learning.

## **Why Teach for Metacognition?**

The traditional emphasis on subject matter knowledge—with little or no time allotted to teach metacognitive and cognitive strategies—may not adequately prepare students for college and career. A report from the National Research Council on “Education for Life and Work” (Pellegrino & Hilton, 2012) identifies three

domains of 21st century competencies—cognitive (thinking and reasoning), intrapersonal (regulating one’s behaviors and emotions to achieve goals), and interpersonal (relating to others and understanding others’ points of view)—that are supported by many of the cognitive assets featured in this text.

No longer is it enough to demonstrate an understanding of the curriculum or to know how to use basic learning skills. Rather, students must be able to deploy content knowledge and apply thinking strategies appropriately on their own in new learning situations. In short, they may benefit from “the full range of metacognitive strategies . . . to monitor and direct their thinking and learning” (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010a, p. 4). As Billings and Roberts note in *Educational Leadership*, the Common Core State Standards emphasize the development of skills to support independent learning and college and career readiness and “assume that teachers are ultimately teaching students to think—the most difficult and important literacy skill of all” (2012/2013, p. 72). Metacognition is at the heart of our approach to learning and teaching students to think.

Instructional strategies that emphasize metacognition in supporting new standards have a solid record of success, according to educational research. In a meta-analysis of 91 studies, Wang, Haertel, and Walberg (1993) determined that metacognition is the number one shared characteristic of high academic achievers. On a more recent list of 150 factors that influence student achievement, metacognitive strategies were ranked 15th; by comparison, student socioeconomic status (which is often assumed to be a major influence on students’ learning potential) was ranked 45th (Hattie, 2012). “Strong learners can explain which strategies they used to solve a problem and why, while less competent students monitor their own thinking sporadically and ineffectively and offer incomplete explanations” (Pellegrino & Hilton, 2012, p. 92). The encouraging conclusion is that the gap between high achievers and struggling students can be closed by guiding the latter to develop a metacognitive approach to learning.

Other research supports both the importance of metacognition for learning across contexts and a wide body of evidence that metacognitive strategies can be taught and learned (Bransford, Brown, & Cocking, 2000; Efklides & Misailidi, 2010; Hacker, Dunlosky, & Graesser, 2009; Hartman, 2002; Lai, 2011; Winne & Azevedo, 2014). A 2014 study by Veenman and colleagues suggests that the ability to apply a metacognitive approach to learning may account for some 40 percent of the variation in academic achievement across a range of outcomes. Lai (2011) reports on classroom research in which teachers included explicit instruction on the use of metacognition alongside math lessons, stating that 8th graders who learned about metacognition outperformed peers in a comparison group in their abilities to interpret graphs, explain math concepts and reasoning, and transfer math knowledge to other applications. In fact, extensive research on the explicit teaching of metacognitive and cognitive strategies indicates that when students are taught how to learn and think, they can achieve at higher academic levels (Allington, 2011; Anderman & Anderman, 2009; Cawelti, 2004; Good & Brophy, 2008; Hartman, 2010; Hattie, 2009; Marzano, 2007; Marzano & Pickering, 2011).

Despite the wealth of research on the importance of teaching metacognition, educational practice in the United States continues to focus almost exclusively on content knowledge. Baker (2013) writes that “metacognitive strategies instruction is still not commonly observed in most primary and secondary classrooms, and interviews with teachers have revealed limited knowledge about metacognition and how to foster it.” A major study of lessons taught in hundreds of elementary classrooms found that, on average, 5th graders received 500 percent more instruction on basic skills than on metacognition and higher-order thinking skills; the ratio for 1st and 3rd graders was 10:1 (Pianta, Belsky, Houts, & Morrison, 2007).

These findings are especially discouraging given that metacognition is at the heart of learning. The Educational Psychology Committee of the American Psychological Association formally

defines *learning* as creating meaningful representations of knowledge through internally mediated processes including self-awareness, self-questioning, self-monitoring, and self-regulation (APA Division 15 Committee on Learner-centered Teacher Education for the 21st Century, 1995). These are the same processes at the core of metacognition, but this approach to learning is not a birthright. Many students do not come to school ready to achieve at high levels. The academic performance of most children and teenagers, whatever their current levels of achievement, can be enhanced by explicit instruction on the use of metacognitive and cognitive strategies. Receiving this instruction can help students to acquire the knowledge and skills they need to succeed as learners in the 21st century and to develop “the cogent reasoning and use of evidence that is essential to both private deliberation and responsible citizenship in a democratic republic” (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010a, p. 3).

Becoming more metacognitive helps learners of all ages—children, teenagers, and adults—proactively determine what they know and what they need to know in order to succeed. A metacognitive mindset toward learning has also been linked to increasing motivation because students who are taught to use these thinking strategies are more confident about their academic abilities and understand that persistence in the sometimes hard work of learning will pay off.

Teachers who have earned their graduate degrees in the programs we codeveloped with Nova Southeastern University (NSU) call metacognition the gift that keeps on giving—to their students and in their own professional practice and personal lives. In a survey of these teachers regarding what they learned about metacognition in their graduate studies, 88 percent of respondents agreed that they are better equipped to teach their students how to be better thinkers, and 83 percent agreed that their students have developed a better understanding of how to improve their own learning (Harman & Germuth, 2012). In an ethnographic

study of program graduates, a kindergarten teacher commented that teaching her students to think about their thinking has helped them to regulate their behavior and choices:

“Teaching them how to think about multiple ways to solve problems has helped students become more focused, calmer, problem-solve more, and better at working out things between themselves versus needing to get the teacher involved,” she said. This way of teaching, she believes, “helps with behavior management” and has resulted in a better classroom climate where her students “have more respect for one another . . . work in harmony more, and work things out more than putting it back on the teacher.” (Germuth, 2012, pp. 12–13)

Another NSU graduate who teaches English as a Second Language to elementary students, credited explicit instruction on the use of metacognitive and cognitive strategies as one factor in the significant decrease in the rate of students who did not meet state reading comprehension strategies, from 72 percent at the beginning of the school year to 17 percent near the end of the year. Regarding the outcome of becoming more metacognitive in her own practice, this teacher noted that “I was able to be more consistent about how and when to use strategies and recognize what works for different kids, and this shows up in [test] scores” (Germuth, 2012, p. 17).

These teachers’ experiences are consistent with the research connecting instruction on the use of metacognition and cognitive strategies to learning gains. Students who succeed academically have learned to think effectively and independently. They employ crucial fundamental skills, such as keeping their workspace organized, completing tasks on schedule, making a plan for learning, monitoring their learning path, and recognizing when it might be useful to change course. Student who succeed academically have been taught to be metacognitive and therefore think effectively

and independently and do not rely on their teacher to initiate learning tasks and monitor their progress. In comparison, students who tend to have lower academic performance have not been taught about cognitive assets or how to manage their learning experience more setbacks, become discouraged and disengaged from learning, and may be responsible for many classroom management issues. Thus, teaching for and with metacognition benefits individual learners and helps to foster a more positive and productive learning environment.

## **Teaching with Metacognition in Mind: Think Aloud to Model Metacognition**

As the lead learner in your classroom, you can make the concept of metacognition more concrete for students by demonstrating it in action across subject lessons. By thinking aloud about the meaning of unfamiliar words and correcting deliberate mistakes in math calculations, for example, you can show students how useful it is to think about your thinking and how metacognition can be applied across contexts in school and outside the classroom. These think-alouds also convey the message to students that everyone—even the teacher—can learn from their mistakes and benefit by thinking about how they learn and how they might improve their learning. This approach recasts missteps from evidence of failure to opportunities to learn and improve. By thinking aloud and using the vocabulary of metacognition, you can effectively model the type of metacognitive discourse that students can employ individually and in small and large groups.

## **Introducing Metacognition and Cognitive Assets**

To help introduce metacognition and cognitive assets to students, we suggest using the following ideas as starting points. These ideas can be adapted for use with students across grade levels and to reflect the lesson content of diverse subjects.

**Introduce the terminology, define it, and use it often.**

Explicit instruction on the use of metacognition, which can be simply defined as “thinking about your thinking as a pathway to better learning,” is appropriate and useful for all students. Children as young as 3 years old can think about their thinking at basic levels and use simple metacognitive strategies to regulate their thinking and behaviors (Kuhn, 2000; Lai, 2011). Georgia teacher Mary Driskill introduces 2nd graders to the term *metacognition* by explaining that thinking about our thinking “helps us to understand why we’re coming up with the answers that we do.” It’s a big word for young students, she acknowledges, but helps drive home the message that they can get smarter by setting learning goals and working hard to achieve them. At the same time, don’t assume older students are familiar with the concept of thinking about their thinking to improve learning. Idaho teacher Michael Fitzgerald (personal conversation, April 25, 2015) says the concept of metacognition is new to many of the high school seniors studying Shakespeare in his English class. “I tell them, ‘Doing school successfully is not just about the subject matter. It’s about the thinking skills you’re learning and how you learn to use your mind metacognitively.’”

**Begin with an explicit lesson on metacognition**, including what it is and how students can use it across all domains to improve their learning. Then incorporate the use of metacognition into core lessons often—perhaps three or four times a day throughout the first week—and touch on it regularly thereafter. We suggest introducing one new cognitive asset per week, as your instructional calendar permits, and tying each new asset into a metacognitive approach to learning to monitor implementation and regular use. In this way, each cognitive asset takes center stage for a week and then is woven into ongoing reminders and opportunities to apply metacognitive and cognitive strategies to specific lessons and activities. As Pellegrino and Hilton summarize the research on teaching metacognition, “Sustained instruction and effort are necessary to develop expertise in problem solving and

metacognition; there is no simple way to achieve competence without time, effort, motivation, and informative feedback” (2012, p. 10). Following an introduction on the importance of applying metacognition to learning, “the teaching of metacognitive skills is often best accomplished in specific content areas since the ability to monitor one’s understanding is closely tied to domain-specific knowledge and expertise” (p. 92).

**Use metaphors to explain and explore how metacognition works** and how students can benefit from becoming more metacognitive. The following “brain car” lesson and the metaphor of driving your brain make the concept of metacognition more concrete and practical for students.

**Catch students being metacognitive**, perhaps when they reflect on their individual learning or engage in metacognitive discourse in group activities, and celebrate it in small or large groups as a way to underscore the many ways this approach to learning comes in handy.

**Lead discussions encouraging students to share examples** of how metacognition can be employed inside and outside the classrooms. When coauthor Donna Wilson teaches metacognition to younger students, she encourages them to share how their parents might use metacognition at work. High school students could think about applying metacognition in their summer jobs and personal interactions with friends and family.

## Lesson: Driving Brain Cars

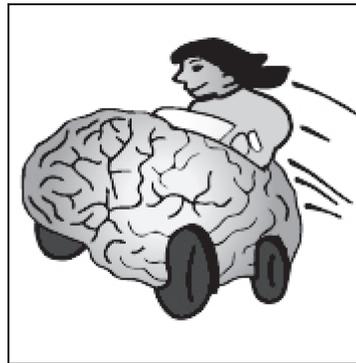
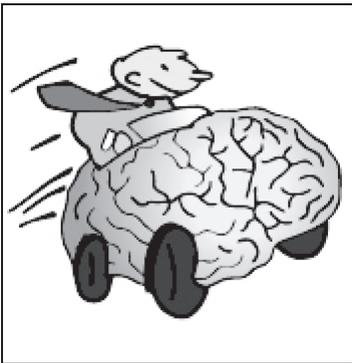
*Level: Upper Elementary*

**Introduce the concept.** The “driving your brain” metaphor is a concrete and engaging way to introduce students to the concept of taking charge of their learning. In this sample lesson with elementary students, the teacher introduces the word *cognition* as “a scientific term for something we do all the time—think!” She continues, “*Metacognition* is thinking about your thinking in ways that can help you become a better

learner.” The teacher shares several examples of metacognition, such as thinking about concentrating on a lesson rather than being distracted by noises in the hallway or by other students; thinking about all the “memory tricks” the class is learning and which one has worked best for you; thinking about developing a plan to complete a project and then checking off each step in the plan to complete the project on time; and thinking about how you did on a test and what you might do differently next time to get a better grade. She asks students to share examples of metacognition inside and outside school and writes their suggestions on the board: thinking about the best ways to research a topic for a paper, thinking about how to organize a book report, making a plan to save money for a new bike and carrying it out, and coming up with fun things to do with siblings and parents on family nights. It is a diverse list and provides many opportunities to discuss the varied aspects of metacognition in planning, implementing, and evaluating outcomes.

**Activity.** Next, the teacher shares the image of the brain cars (see Figure 1.1) and introduces the metaphor of “driving your brain.” By becoming more metacognitive, she explains, you

FIGURE 1.1

**Brain Cars**

can drive your brain to better learning. She provides a couple examples of steering clear of distractions and knowing when you need to back up to make sure you understand the lesson and when you can speed on to the next idea. The teacher passes out sheets with the brain car and asks students to add a label about how they can drive their brains to better learning with metacognition. Again, their ideas are diverse and creative. One student adds a drawing of a TV with a red X over it and adds a label that he needs to “drive past video games until my homework is done.” Another writes, “When I look up the right answers and write them next to the ones I missed on a test, I am driving my brain to an A!” A third student, remembering a recommendation the teacher has repeated often, writes, “Practice, practice, practice makes me the best brain driver!” One student embellishes his brain car to show it speeding so fast that flames are shooting out the back. Another adds a long and winding road around the car and notes, “My brain car is going far.”

**Transfer the learning.** The teacher collects the brain cars and displays them around the room. Throughout the week, she mentions metacognition and the brain cars in lessons: “Let’s be metacognitive about planning this science experiment. What are we trying to figure out, and what evidence should we be collecting?” “Let’s put our brain cars in reverse and think if there’s another way to solve this math problem.” “How do you think the first settlers in our state used metacognition in deciding where to build their homes?” Soon the students are following her lead. When she asks a student how he figured out the meaning of an unfamiliar word, he replies, “I thought about what I was thinking about the rest of the sentence and how that word might fit.” The teacher hears another student in a reading circle remark about a character: “If she would only be more metacognitive, she wouldn’t make the same mistake again and again!” When the teacher asks the class “What makes the best brain car driver?” the students often respond in unison, “Practice, practice, practice!”

**Extenders.** Using the brain car metaphor to teach students about metacognition is effective even for very young children, who might enjoy adding noises and motions as reminders for speeding along, stepping on the brakes, and steering clear of obstacles to learning. It can also be an effective, extended metaphor for middle school and high school students, especially if they are just being introduced to the concept of taking charge of their learning by practicing metacognition. A question for older students might be: “Many of you are excited about the prospects of getting your driver’s license. But what are the benefits of learning to drive your brain?”

Keri Shaver, who works with individual high schoolers online through Florida Virtual School, says a metacognitive approach to learning offers students a variety of thinking strategies to keep trying until the light bulb comes on. “Their confidence increases once they realize they have potential to learn and achieve. The cognitive assets I found especially useful had to do with time management. I was able to use those as strategies to keep them on schedule,” she says. “I could say, ‘You want to get this class done by December, correct? And how many weeks is that?’ I put the ownership in their hands.”

### **Metacognition Checkpoint**

Encourage students to take a metacognitive approach to learning by asking themselves questions like these:

- How can metacognition help me learn better?
- Am I driving my brain right now, or is my brain on auto-pilot and steering away from learning?
- In thinking about how I studied for this test, are there things I can do to improve my study habits?
- Are there other ways to think about this problem and possible ways to solve it?

## Metacognition in Your Professional Practice

Emphasizing the “language of learning”—or referring regularly to metacognition and the cognitive assets to remind students to think about their thinking—pays the dividend of reinforcing the positive aspects of being metacognitive about your teaching practice.

- In planning lessons, ask yourself: What are the most important elements of this lesson? Where might students encounter difficulties? How can I measure how effectively students have learned them? How can I tie this new content to their prior knowledge? Which metacognitive strategies and cognitive assets should I remind students to activate to make the most of this learning?

- While engaged in the lesson, monitor learning with questions like these: Is this lesson going as I planned? If not, what is leading us off course? Are we proceeding at the right pace? How can I keep students who have demonstrated their understanding of this new content engaged and moving forward, while providing additional practice for other students who are still working to learn? Is there any content that seems confusing or unclear? What unexpected connections are students making, and how can we capitalize on that?

- In evaluating outcomes, review these issues: Do the assessments demonstrate that students have mastered this new content? Do some students need additional support or reviews? What might I do differently the next time I teach this lesson? What was unexpected, in both positive and challenging ways? Can we apply this new knowledge to other subjects and build on the learning?

Questions like these are at the heart of teaching with metacognition, as is continually monitoring instructional effectiveness and learner engagement. Using questions will help the “learning brains” in your classroom—those of your students and your own!—focus productively on the task at hand.

# About the Authors

---



**Donna Wilson**, leader of the academic team at BrainSMART and the Center for Innovative Education and Prevention, is an educational and school psychologist and former teacher. Donna is codeveloper of graduate studies in mind, brain, and education science at the master's through doctoral levels and has facilitated professional development with tens of thousands of educators. Some of her current projects include work in partnership with the Blue Ribbon Schools of Excellence, numerous speaking engagements with educators and policy makers across the United States, a countrywide implementation in Jamaica, and professional development engagements in various locations around the world. Her passion is supporting teachers and administrators by modeling practical strategies grounded in research on how people learn. To bring Donna to your district, contact her at [donna@brainsmart.org](mailto:donna@brainsmart.org). View her blog at <http://donnawilsonphd.blogspot.com/> or connect with her on LinkedIn under Donna Wilson, Ph.D.



**Marcus Conyers** is a doctoral researcher at the University of Westminster and director of research and development for the Center for Innovative Education and Prevention. He is the founder of BrainSMART and coauthor of 20 books on applications of mind, brain, and education science, he has led statewide initiatives and worked in 30 countries, reaching more than 100,000 administrators and teachers. Marcus has presented at academic conferences at universities in the United States and Canada, at the University of Cambridge in the United Kingdom, and at Leiden University in the Netherlands. Beyond educational audiences, he is committed to sharing practical applications on the benefits of becoming more metacognitive with professionals in business and government organizations. To bring Marcus Conyers to your district contact him at [marcus@brainsmart.org](mailto:marcus@brainsmart.org). View his website at <http://www.innovatingminds.org/>, his blog at Innovating Minds, and connect with him on LinkedIn.

Both **Donna Wilson** and **Marcus Conyers** are on the web at [www.brainsmart.org](http://www.brainsmart.org). You can also find them on Facebook at BrainSMART, and follow them on Twitter @BrainSMARTU and Pinterest at BrainSMARTU.

## **Related ASCD Resources: Brain and Teaching**

At the time of publication, the following ASCD resources were available (ASCD stock numbers appear in parentheses). For up-to-date information about ASCD resources, go to [www.ascd.org](http://www.ascd.org).

### **ASCD EDge® Group**

Exchange ideas and connect with other educators interested in “Let’s Talk the Brain and Learning” or “Brain Compatible Learn” on the social networking site ASCD EDge® at <http://ascdedge.ascd.org/>

### **PD Online® Courses**

An Introduction to the Whole Child (#PD13OC009M)

### **Print Products**

*Activating the Desire to Learn* by Bob Sullo (#107009)

*Brain Matters: Translating Research into Classroom Practice, 2nd Edition* by Patricia Wolfe (#109073)

*The Brain-Compatible Classroom: Using What We Know About Learning to Improve Teaching* by Laura Erlauer (#101269)

*Memory at Work in the Classroom: Strategies to Help Underachieving Students* by Francis Bailey and Ken Pransky (#114005)

*The Motivated Brain: Improving Student Attention, Engagement, and Perseverance* by Gayle Gregory and Martha Kaufeldt (#115041)

*The Motivated Student: Unlocking the Enthusiasm for Learning* by Bob Sullo (#109028)

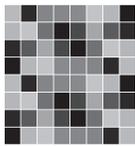
*Research-Based Strategies to Ignite Student Learning: Insights from a Neurologist and Classroom Teacher* by Judy Willis (#107006)

*Teaching to the Brain’s Natural Learning Systems* by Barbara K. Given (#101075)

*Teaching with the Brain in Mind, 2nd Edition* by Eric Jensen (#104013)

*Understanding How Young Children Learn: Bringing the Science of Child Development to the Classroom* by Wendy L. Ostroff (#112003)

For more information: send e-mail to [member@ascd.org](mailto:member@ascd.org); call 1-800-933-2723 or 703-578-9600, press 2; send a fax to 703-575-5400; or write to Information Services, ASCD, 1703 N. Beauregard St., Alexandria, VA 22311-1714 USA.



# THE WHOLE CHILD

ASCD's Whole Child approach is an effort to transition from a focus on narrowly defined academic achievement to one that promotes the long-term development and success of all children. Through this approach, ASCD supports educators, families, community members, and policymakers as they move from a vision about educating the whole child to sustainable, collaborative actions.

**Place book title here**

relates to (insert tenet copy here).

## WHOLE CHILD TENETS

- 1 HEALTHY**  
Each student enters school healthy and learns about and practices a healthy lifestyle.
- 2 SAFE**  
Each student learns in an environment that is physically and emotionally safe for students and adults.
- 3 ENGAGED**  
Each student is actively engaged in learning and is connected to the school and broader community.
- 4 SUPPORTED**  
Each student has access to personalized learning and is supported by qualified, caring adults.
- 5 CHALLENGED**  
Each student is challenged academically and prepared for success in college or further study and for employment and participation in a global environment.

For more about the Whole Child approach, visit  
[www.wholechildeducation.org](http://www.wholechildeducation.org).

**ASCD**  
LEARN. TEACH. LEAD.