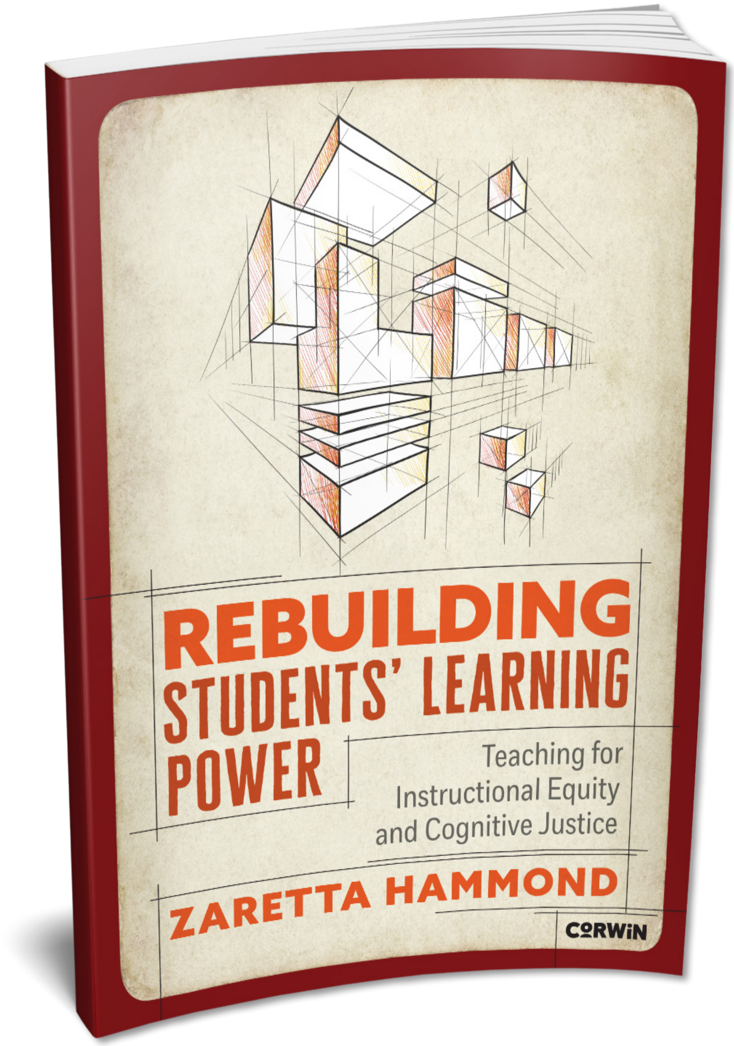

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Chapter 2

Moving Toward a Pedagogy of Possibility

"Give a man a fish and he eats for a day.
Teach a man to fish and he eats for a lifetime."

—Lao Tzu
Philosopher

This chapter deconstructs the skills and dispositions students need to become a good information processor who is resistant to the impact of inequity by design. This chapter will answer these questions:

- What is the difference between information processing and executive function?
- What are the science of learning principles that support skills of a good information processor?
- What is the connection of each disposition and skill of a good information processor to equity and rigorous learning?

As I said in the opening chapter, achieving equity requires system change, coherence across all the moving parts, and a culture of continuous improvement. But the heart of the work is in the instructional core where teaching and learning happen. That is where we grow cognitively independent learners. When I ask educators I'm working with why they are embracing **instructional equity**, they enthusiastically reply, "We want our students to be independent learners!"

But, I soon discovered that equity-focused educators aren't always clear on what an independent learner looks like. I learned this first-hand working with a middle school team. The teachers at the school had been given the book *Culturally Responsive Teaching and The Brain* (Hammond, 2014) to read, and the language of independent learners resonated with them.

During one of my visits, the assistant principal (AP) and I were doing a series of walk-through observations. Kurt and I went into a social studies classroom and took seats in the back of the classroom. The twenty-six students were orderly and quiet. All eyes were directed to the front of the room. The teacher was interesting, and the students dutifully followed along. At regular intervals, they would look down to scribble notes.

When directed to, they turned and talked to each other until the teacher struck his five-tone chime. With each stroke of the bamboo mallet, students began wrapping up their conversation until there was silence again. Then, he asked them to share. Immediately, eight or nine hands went up, with a few waving feverishly. He called on them without hesitation. From there, he and those students who had raised their hands had an interesting and lively discussion.

Meanwhile, I could see the attention of those students who had not raised their hands quickly drifted off. They were at different levels of "polite" disengagement. They weren't acting out and appeared to be paying attention—sitting up straight, leaning in a bit, eyes tracking the teacher. They maintained this posture but didn't engage unless called on. I looked closer. Like when your eyes adjust to a dark room, I slowly started to see others who were a bit more disengaged—a girl doodling in her notebook. The boy adjacent to me was sitting with his head in his hand, looking forward with a blank stare, trying to be polite, like when your parents force you to a social function you don't want to be at. No one had their head down or a hoodie over their head. That was against their classroom rules, which were prominently displayed in the front of the room.

We stayed a few more minutes, then left as discreetly as possible. As Kurt and I walked down the flight of stairs back to the office, in unison we said, "Oh wow. That was interesting." We looked at each other and chuckled. "You first," I said. "What was interesting about what you saw," as our heels click-clacked in the empty hallway. He shared his excitement at how "independent" the students were in moving through the lesson and the level of excitement from the kids that raised their hands. He thought it was great middle-school teaching and learning. Then he asked my opinion.

I shared that I had a different take on what I'd observed. First, I acknowledged that those who raised their hands were very engaged, but I wondered about the rest of the class. The other eighteen students were orderly but not cognitively engaged. I interpreted their behavior as highly compliant. In addition, I observed that the teacher only engaged the students whose hands went up first. I didn't see how those students who might have been struggling or who were still mastering English were invited into the teaching and learning circle. They seemed to be a class of students but not a community of learners.

That exchange with the assistant principal opened up an important conversation with the school leadership team about the difference between compliant learners and truly independent learners. "Doing as you're told" is often misinterpreted as independent learning for "those kids." Students who are truly cognitively independent learners aren't because they're compliant but because they are skilled at using a well-developed set of mental operations to process the content.

The walk-through with Kurt the AP led to two important insights that year. My first insight was that even educators using innovations like project-based learning, universal design for learning (UDL), deeper learning, or arts-integrated instruction defaulted to compliant learning behavior to describe what "good teaching and learning" should look like. They wanted high engagement and compliant behavior.

That same year I was working with AP Kurt and his school team, I was supporting teachers in four different settings—an elementary school in Minnesota, a middle school in San Francisco, a high school in a diverse suburb outside of Oakland, California, and an East Coast charter school network. In addition, I was working with a cohort of school teams in an action research initiative sponsored by the New York City Department of Education. While each context and setting was different, I began to notice a common phenomenon across all of them. Compliant student learning behavior was being mislabeled as independent learning. This led to my second insight: shared language, shared mental models, and shared conceptual understanding matter when we are engaged in equity-focused professional learning with colleagues. We need to have an agreed-upon definition of a concept like "independent learning" to avoid promoting inequitable practices masquerading as good teaching.

Central to *Culturally Responsive Teaching and The Brain* was the idea that we need to develop cognitively independent learners as part of our equity equation. That message resonated deeply with educators. As they tried to move from theory to practice, many leaders, instructional coaches, and teachers tried to package turnkey scripts and strategies to add to their pacing guides rather than focus on the student as the unit of change. This is a point researcher Joanne Golann highlighted in her book, *Scripting the Moves: Culture and Control in a "No-Excuses" Charter School* (2021): "We have seen how schools' fixed scripts shape the skills students develop, limiting opportunities for student to develop the flexibility to learn how and when to express an opinion, advocate a position, and make an independent decision." It is this flexibility with processing externally with others as well as internally as a learner that is essential.

Inequitable opportunities for rigorous learning create a cognitive redline that aims to arrest students' cognitive agility. It is the primary lever for maintaining inequitable academic outcomes for Black, Latino, Indigenous, and poor children. While underdevelopment may not be a conscious act on the part of individuals running our school systems today, it is a deeply embedded mechanism in our policies and practices that on its face doesn't appear racialized or targeted at historically marginalized students. Jal Mehta (2022), building on the foundational work of David Tyack and William Tobin, describes the "**grammar of schooling**" as the deeply entrenched organizational structures and practices that have defined American education for over a century. Some of the elements of this grammar typically include:

- Age-graded classrooms where students progress based primarily on age rather than mastery
- Separate subject areas taught in isolation from one another
- Teachers working alone in self-contained classrooms
- Learning is truncated to fifty-minute blocks of time
- Curricula and assessments are standardized and packaged as one size fits all
- Credits that count toward graduation are awarded based on seat time rather than demonstrated competency

These elements are the water we swim in. They are the unexamined wallpaper that we don't pay attention to anymore. Instead, we assume because students sit in classrooms six hours a day and participate in lesson activities, we are developing their brains and that they are learning. When end-of-the-year data come up short, we assume that the problem is student motivation, a lack of belonging, or a need for cultural affirmation.

Mehta (2022) argues that these structures have proven remarkably resistant to change despite numerous reform efforts. He notes that this grammar emerged during the early twentieth century as schools adopted factory-model efficiencies and bureaucratic organization to handle mass education. In *The Allure of Order: High Hopes, Dashed Expectations, and the Troubled Quest to Remake American Schooling* (Mehta, 2013) and *In Search of Deeper Learning* (Mehta & Fine, 2019), Mehta examines how this grammar constrains meaningful educational reform and limits opportunities for deeper learning. He argues that truly transformative education requires challenging these fundamental organizational patterns rather than merely implementing surface-level changes.

Begin With the End in Mind

If we make the solution to closing achievement gaps about engagement or belonging alone, we typically bypass scrutiny of our teaching practices. In reality, what needs to change is our ability and effort to build, and in some cases, rebuild underperforming students' learning power. That begins with understanding the role information processing plays in deep learning and effective instruction. This is the heart of instructional equity.

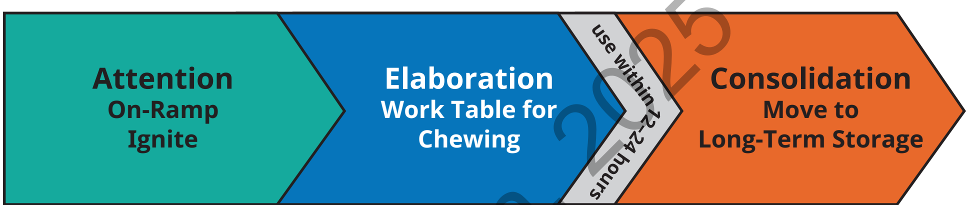
Where do we start? Let's begin with the end in mind. In this chapter, I outline the portrait of a good information processor, building on the popular effort by state departments of education and school districts to create a "profile of a graduate." A profile of a graduate typically identifies the skills, knowledge, attributes, and competencies necessary for a successful transition to life after high school. It serves as an accessible, succinct description of what every graduate must know, understand, and be able to do as a successful high school graduate who is college and career ready. In addition, it serves as a north star for backward planning as we design teaching, learning, and policy to help teachers support our most vulnerable students reach these milestones.

Similarly, I have constructed a portrait of a cognitively independent student, not just a profile. A profile is only the outermost shape, view, or edge of an object. It's simply an outline. I want to offer a fuller, more complete picture to help you build *your* understanding of what a good information processor does to build their skills, dispositions, and capacity as they can grow *their* learning power. Each of the six core components must be developed deliberately and then integrated to create a holistic, synergetic effect. Before we get into the six components of the good information processor, we need a shared understanding of what I mean by information processing.

A Simple Overview of Information Processing

The brain's information processing system is made up of three core phases (Figure 2.1).

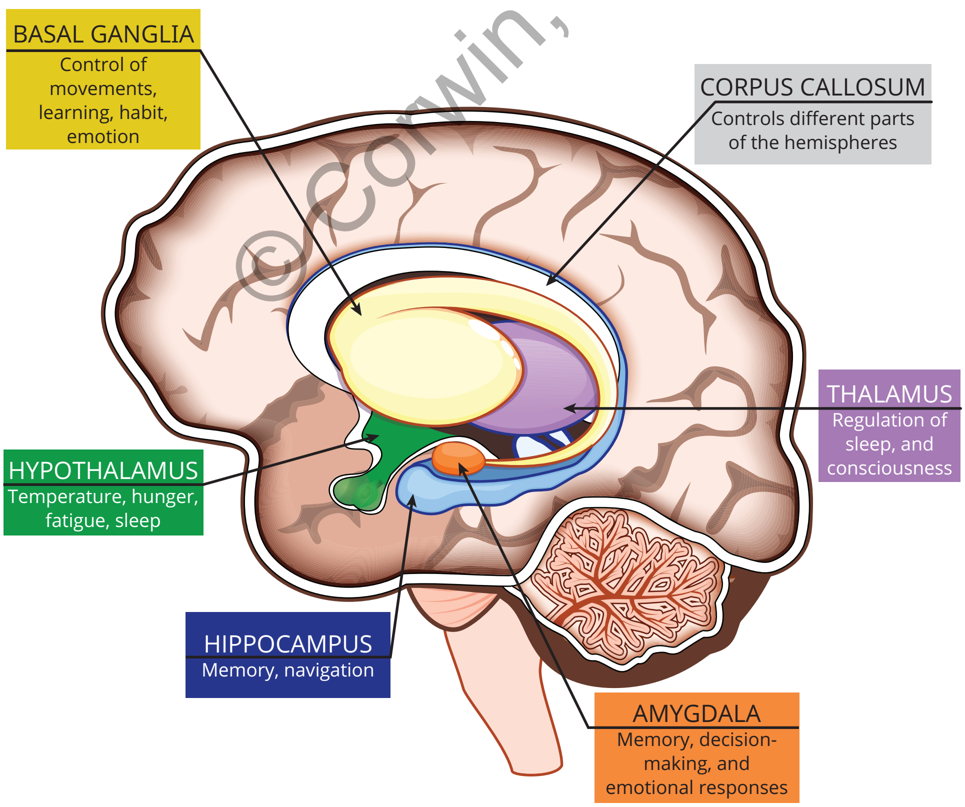
Figure 2.1 • The Brain's Information Processing Cycle



The first is ***attention*** (where we put our focus determines what information we let into our consciousness). This is where executive function and information processing overlap. Next is ***elaboration*** (how we take apart, mix together, and connect new content in our working memory). The final phase is ***consolidation*** (how we move useful knowledge from our working memory's "workbench" to long-term storage in our schema (background knowledge). Consolidation has been largely associated with retrieval practice (Agarwal & Bain, 2019). While it is important for students to know how to go in and get information out of their long-term memory, it is most important for them to know how to store it there in the first place. But, keep this in mind: students cannot retrieve information they have not processed and converted to schema. That is why retrieval practice, interleaving, and spacing are secondary cognitive skills. They aid **myelination** rather than information processing itself. The parts of the brain responsible for information processing reside deep in three key areas: the basal ganglia (responsible for **cognitive routines** and habits), the hippocampus (long-term memory), and the insula (emotion and working memory). The basal ganglia are a group of interconnected structures located deep within the brain that work together like a traffic controller to help facilitate learning and habit formation. It's essential in procedural learning—processes like riding a bike or typing on a keyboard. The basal ganglia help turn these initially conscious actions into automatic behaviors.

In addition, it's involved in motivation, reward-based learning, and decision-making. Its central location in the brain is crucial for its function, as it allows the interconnected structures to effectively communicate simultaneously with both motor and cognitive areas of the brain through extensive neural connections. The insula is particularly interesting and underestimated. With up to thirteen subdivisions, it serves several functions, ranging from sensory perception and affective processing to high-level cognition. It is the seat of the emotional side of cognition. Notice how close to the **amygdala** the basal ganglia and insula are, linking cognition and emotion (Figure 2.2).

Figure 2.2 • The Basal Ganglia: Center of Learning, Habits, and Emotion



Source: iStock.com/ttsz

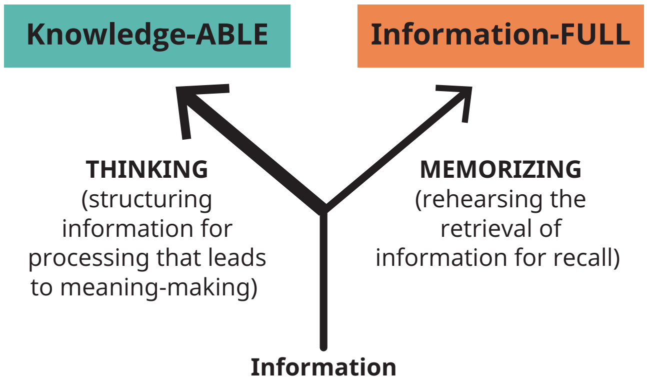
Information Processing Versus Executive Function

So, what about executive function, you might be asking right now. Aren't these the same thing? Most educators use these terms interchangeably. Information processing and executive function are related but are not the same thing. Executive function (EF) is an umbrella term in neuroscience to describe the neurological processes involving mental control and self-regulation. It is important in its own right. EF skills encompass a wide range of enabling skills like planning, organizing, self-regulation (including managing attention and emotions), learning, and memory. The brain's executive functions are located in its **prefrontal cortex**, which controls and regulates cognitive and social behaviors like impulse control, paying attention, planning and organizing time and materials, and responding appropriately to social interactions and stressful situations. We associate executive function with good study skills, time management, and self-regulation. When we are helping students develop study skills, organize their binders, and master time management, we are helping them strengthen their executive functioning skills.

On the other hand, information processing takes new content and mixes it with existing background knowledge to make it usable. It is your brain's "digestion" system, similar to how your digestive system takes food in through the mouth and sends it through various stages to break it down so it can be absorbed and utilized by your body.

Once a person has mastered learning how to learn, the brain recruits the prefrontal cortex to help maintain one's capacity. Information processing before study skills. Executive functioning helps us continue to grow as learners, especially when we are moving between **metacognition** and metastrategic planning. We'll explore that in more detail in Chapter 7. For now, remember that the brain's prime directive is learning—turning inert content and experiences into usable knowledge that has meaning and deepens understanding of the content being learned. Its goal is to be "knowledge-able," not just "information-full" (Figure 2.3).

Figure 2.3 • We Want Students to Be Knowledge-Able



Source: Cabrera, D., & Colosi, L. (2012). *Thinking at every desk: Four simple skills to transform your classroom.* W. W. Norton & Company.

Cognitive Structures and Productive Struggle: The Twin Engines of Information Processing

When students can't convert a lesson's content into something meaningful, we get that bewildered blank stare. You know the blank stare. It's that look students give when they aren't grasping a concept when you're talking or when they must apply a formula to do a calculation. As frustrating as it is to see the blank stare, it is instructive. It signals that the student has underdeveloped cognitive structures and may need support to strengthen their information processing capacity.

The brain's cognitive structures are the gears and mechanisms used in the first two phases of information processing, attention and elaboration, that move the learner from confusion toward clarity, then from clarity to understanding. The name "cognitive structures" is a bit of a misnomer because a cognitive structure isn't a static "structure" at all but a set of mental operations and a network of neural pathways that fire together in the process of meaning-making, problem-solving, pattern-recognition, and figuring things out while grappling with new content in the working memory.

All students come to school with the ability to learn because that is the brain's main function. Every learner's brain cycles through these phases multiple times a day without much effort because the brain is a learning machine. Yet, information processing isn't a one-size-fits all thing. Like fingerprints—everyone has them, but each set is unique. Everyone has cognitive structures and an information processing system, but each person has their own unique set of cognitive structures that creates their own signature **learning algorithm**. We usually associate the word *algorithm* with math or computer science. An algorithm is simply a step-by-step procedure or set of rules designed to solve a specific problem or perform a particular task. Think of it as a recipe or instruction manual that tells you exactly what to do at each step to achieve a desired outcome. A cooking recipe is an algorithm. The method you use to tie your shoes follows an algorithm. But to do increasingly complex academic work, each student must hone their learning algorithm and know how to increase its sophistication with each passing grade level.

Here's our challenge: Cognitive structures aren't directly observable, so the concept can seem abstract, which makes it hard to know how to grow and strengthen them in our students. To make it more concrete, I'll use the party game *Taboo* to illustrate. On the surface, the game looks really simple. But, when you deconstruct the moves of the game (its algorithm, if you will), it helps us see this abstract idea in action. Here goes. The game is played between two teams. The objective of the game is for a player to get their teammates to guess a word without using common words to describe it. The player draws a card that has the word you are trying to get your team to say on it and five other words that are "taboo" to say.

Now, what's fun about *Taboo* is that it doesn't matter how you get your teammates to say the word without pantomime (but word association is totally allowed). See Figure 2.4 for an example.

Figure 2.4 • Let's Play a Game!

Let's try it. The word is NIGHTMARE. The following are the five words you cannot say:

- Dream
- Bad
- Sleep
- Elm
- Scary

Stop reading, and go try it out on a friend or colleague. Ask them to humor you and play along. Tell them you are trying to guess the word you have in mind, and you will provide some one word clues.

Oh, and the game is timed. You have ninety seconds to get them to say the taboo word. Go!

Did you notice what you had to do in your brain to get them to say the word? Let's deconstruct the mental operations you went through. First, you looked at the word and began scanning your schema (also known as funds of knowledge or background knowledge) for your own understanding of the word and its associations.

Once you've scanned your schema for what you know about the word and different ways it's used, you edited out the forbidden words. That means you go back down a few other branches of your schema. You identify a few different associations that aren't so linear that might be helpful to your teammates.

Next, armed with your new associations that don't include the "taboo" words, you have a few options to try. You look at your colleague and take an educated guess as to where your schema and their schema overlap. You have to process quickly what might be a shared body of knowledge between the two of you. Once you begin talking to get them to say the word, you soon realize they are off-base and try a different set of associations to see if you can get them to blurt out the word. Now, mind you, the timer is running. These mental steps have to take micro-seconds.

Hopefully, you were able to get your colleague to say the word. The brain rewards this mental effort with dopamine, a feel-good neurochemical designed by nature to reward us for doing hard things. Dopamine encourages us to take cognitive risks and stretch our learning to the edges of our zone of proximal development.

Productive Struggle Is a Good Thing

Productive struggle and cognitive structures are the twin engines that drive information processing. Novice educators sometimes believe any type of struggle means the student has a problem. Learning science tells us that the opposite is true. Learning requires productive struggle. You have to actively grapple with new content or wrestle with a problem to build understanding. According to Lev Vygotsky, this is what is happening in the learner's *zone of proximal development* (ZPD). The ZPD is the demarcation for the cognitive redline. On one side are the dependent and compliant learners who stay in their comfort zone, and on the other side are cognitively independent students who routinely stretch past their growing learning edge.

Think of the ZPD as the "equity zone." To close our chronic achievement gaps, we get our most vulnerable learners into the equity zone regularly so they can close their learning gaps, deepen their capacity for learning transfer, and accelerate their learning in the process. But this means helping them build and expand their cognitive structures. It means developing their stamina for engaging in productive struggle. To have true agency, they will need more than voice and choice. To have a voice as the leader of their own learning and to have real choices in the future regarding an area of study they'd like to pursue or which college they'd like to attend, they must become good information processors.

The Self-Directed Learner and Information Processing Prowess

In the last decade we have seen the rise of cognitive neuroscience and the science of learning inform teaching and learning. That's why when I bring up information processing I often hear teachers say, "Oh, I already do that." Because we have incorporated brain breaks and other brain-based and trauma-informed practices, many may think we're already focused on improving information processing. At the same time, there's been a strong push toward rigor for all in the classroom, from incorporating Karin Hess's rigor matrix (2023) that overlays Bloom's taxonomy with cognitive science to school teachers doing "rigor walks" in the tradition of instructional rounds. School districts built professional learning communities, continuous improvement methods, and communities of practice around the idea of increasing curricular rigor and providing grade-level materials in the pursuit of deeper learning.

These methods were helpful, but in the end, their focus is squarely on what the teacher taught and less on how the students learn. The emerging deeper learning movement is shining a brighter light on how students learn. Ron Berger of EL Education, was an early pioneer in shifting our gaze from solely looking at what the teacher was doing to looking more closely at the learner. In The *Ethics of Excellence* (2013), Berger gives a vision of educational reform that transcends standards, curriculum, and instructional strategies. He argues for a paradigm shift to an "ethic of excellence" that centers the student as a learning "craftsman" and teaching as a culture of craftmanship.

In the same year, the William and Flora Hewlett Foundation offered a set of deeper learning competencies that explicitly included the "craftmanship of learning," including self-directed learning and building learn-to-learn skills as key competencies successful students have to master for the future. Here are all six competencies:

- Mastery of rigorous academic content
- Development of critical thinking and problem-solving skills
- The ability to work collaboratively
- Effective oral and written communication
- Learning how to learn
- Developing and maintaining an academic mindset.

Since I began to write about dependent and independent learners in *Culturally Responsive Teaching and The Brain* in 2014, the idea of the self-directed learner has found its way into the mainstream. I hear teachers using the terminology regularly. Leaders are building schools around the concept (e.g., The Forest School). Yet, for our average public school student, we tend to focus more on social-emotional competencies—collaboration, mindset, communication—over the foundational skills of building information processing skills and learning how to learn as part of the craftmanship of schooling.

As social-emotional learning (SEL) became more popular, we saw social, emotional, and relational competencies take center stage alongside the rising interest in 21st-century skills for future career readiness. This set of competencies, affectionately known as the 6Cs, was developed by the

Partnership for 21st Century Skills (Battelle for Kids, 2019). This set came on the heels of the Ontario Ministry of Education (2016) declaring its own set of global competencies (Table 2.1).

Table 2.1 • Common Global Competencies

21st Century Skills	The Six Global Competencies
• Critical thinking • Communication skills • Creativity • Problem solving • Perseverance • Collaboration	• Critical thinking • Problem solving • Communication • Collaboration • Creativity & innovation • Self-directed learning • Citizenship

Source: Partnership for 21st Century Learning, 2019.

Source: Ontario Ministry of Education, 2016.

Both sets of competencies are essential for all students to reach their fullest potential. These competencies—whether it is the "new pedagogies" of the 6Cs or the 21st Century skills—are fundamental to the process of getting students ready for rigor. Cognitive neuroscience tells us that the brain needs more (Brown et al., 2014). Yet, in this era of social-emotional learning and development, we have leaned heavily into character education, the science of motivation, and growth mindset development, which makes the 6Cs and 21st-Century skills attractive as a key focus of collective equity work for a district. But these competencies alone will not do much to disrupt cognitive redlining if students cannot turn new content introduced to them during a lesson into usable knowledge through the productive struggle of information processing. Students who are dependent learners cannot engage in critical thinking or problem-solving without a strong foundation of basic cognitive structures and effective information processing. These are essential to becoming a self-directed learner.

Learn-to-Learn Skills Build Information Processing Prowess

In *Building Background Knowledge* (2004), Robert Marzano highlighted the importance of information processing ability in building knowledge (Figure 2.5). He points out that information processing's impact on academic achievement is equal to, if not greater than, exposing students to academic enrichment experiences like visiting museums, traveling, theater, and so on. It is essential to expanding struggling students' ability to comprehend and problem-solve. Through information processing, the brain connects dots, grasps concepts, engages in critical analysis, and turns random facts and figures into actionable knowledge—information you can use to solve a problem, navigate a situation, or figure something out.

> ***Learning power is to the brain as horsepower is to a car engine. The engine is what makes the car go. In our case, learning power allows the student to carry the cognitive load.***

Despite its importance, Marzano's introduction to information processing didn't highlight its connection to the Hewlett Foundation's learning-how-to-learn competency. While texts like *Make It Stick: The Science of Successful Learning* (Brown et al., 2014) and *How the Brain Learns* (Sousa, 2022) discussed the structures and processes of the brain, we didn't learn techniques to improve these capacities in our underperforming dependent learners. Learning how to learn is the explicit pedagogy students need to strengthen their learning algorithm.

My point throughout this book is that we must make the invisible craftmanship of learning visible to students so they can understand how to manipulate the various parts and processes that grow their learning power. Learning power is to the brain as horsepower is to a car engine. The engine is what makes the car go. In our case, learning power allows the student to carry the cognitive load. More importantly, it isn't a thing they get or that we can give them, like a new strategy to use. It is a capacity they must grow. The goal is for students to have the knowledge, skills, and inclination to (re) build their learning power.

Figure 2.5 • Building Background Knowledge

Information Processing Ability \ Access to Academically Oriented Experiences	LOW	MEDIUM	HIGH
HIGH	**Delbert**	**Barbara**	**Allen**
MEDIUM	**Gina**	**Ethan**	**Calvin**
LOW	**Iris**	**Hilda**	**Frank**

Source: From *Building Background Knowledge for Academic Achievement*, by Robert J Marzano, Arlington, VA: ASCD. © 2004 by ASCD. Reprinted with permission. All rights reserved.

In this chapter, we deconstruct the skills and dispositions students need to master on their way to becoming a good information processor. Keep in mind that these don't exist in isolation. The science of learning reminds us that effective learning requires synergetic integration of the cognitive, social, academic, and emotional elements working together. Information processing is a synchronized and dynamic dance the brain does, not a one-time event. The three phases we discussed earlier—attention, elaboration, and consolidation—don't operate in silos; they are integrated and interlocking parts of our brain's information processing systems that recruit executive functions as well as our social-emotional parasympathetic system.

Six overlapping skills, dispositions, and processes make up a student's internal cognitive architecture. Ideally, a student would cultivate them from first grade through tenth grade. There is a compound effect that happens from grade to grade. Information processing prowess expands exponentially as students get more competent at processing new content that deepens their understanding. As students' competence grows, so does their confidence. As they experience more confidence, they are more inclined to stretch themselves cognitively and let go of dependent learning behaviors to reach higher levels of mastery in a subject area or with a skill.

The Portrait of a Good Information Processor

Mastering learning-to-learn skills happens incrementally and compounds over time. A student becomes a good information processor (Figure 2.6) through deliberate practice and productive struggle. Over time, we see their ability to carry more of the cognitive load expand. It is this expansion that increases the amount of gray matter in the brain. As their neural pathways grow, they begin to bump up against the cognitive redlines that may have previously limited them.

Figure 2.6 • The Portrait of a Good Information Processor

These capacities aren't in a linear order. Remember, every student's algorithm is unique and can be initiated from any point. But for our purpose here, I've deconstructed and numbered them. For each one, I answer the following questions:

- What is it?
- Why does it matter?
- What's the equity connection?
- How does it contribute to disrupting cognitive redlining?

1. **Good information processors manage their overall information processing systems.**

What is this? The ability to control one's cognitive performance is one of the essential capacities of a cognitively independent learner. This doesn't mean the student is able to name the parts of the information processing system. It means the student has learned to ignite the cycle by directing their attention with intellectual curiosity. They have learned some fundamental moves for connecting new content to what they already know during the elaboration stage. They know that productive struggle, challenge, failure, and feedback all help them during this phase to make learning sticky and understandable. This aspect of being a good information processor corresponds to the principle of malleability through neuroplasticity.

Why does it matter? Having the ability to manage one's information processing systems matters because it takes a combination of metacognition and metastrategic awareness to engage in productive struggle and to use feedback to change one's learning moves. The learner cannot close learning gaps or accelerate learning without having conscious command over this process. For every learner, this process is carried out uniquely, so the learner has to be aware of their cognitive moves rather than follow some scripted strategy given by the teacher. This command builds a sense of competence, which fuels a student's confidence.

What's the equity connection? Instructional equity recognizes that each learner comes to school with a culturally grounded information processing system, regardless of how underdeveloped it is for academic learning. Our task is to help students from diverse collectivist cultures use their community-based learning modalities to ignite and drive their information processing to move content from surface learning into deeper understanding. Sometimes, they are told that their learning behaviors don't align with school-based, academic learning. In reality, educators don't always recognize the ways diverse students are actively processing content because it doesn't look familiar to them. Instead, we often promote following directions over letting the student build on their existing information processing algorithm.

How does this help disrupt the cognitive redline? Self-awareness is the first building block in self-directed learning. The mechanisms of inequity were designed to keep students ignorant of their learning power. To begin disrupting the cognitive redline, we have to create the conditions for students to become metacognitive and, ultimately, metastrategic around their learning moves. By improving their information processing skills, they strengthen their critical consciousness and analytical skills.

2. **A good information processor cultivates and nurtures the internal attitudes and dispositions that initiate, activate, and direct their cognitive behaviors.**

What is this? Dependent learners, out of learned helplessness, wait for the teacher to initiate their **information processing cycle** during a lesson by telling them what they should be paying attention to. Learned helplessness makes igniting the information processing cycle difficult. Dispositions toward learning serve as a bridge between our emotions and cognition. Do we get excited about learning, or do we resist unless coaxed? Do we lean toward intellectual curiosity or not? This is the affective (social-emotional) part of learning power.

Dispositions affect students' ability to apply effort to the process. They are the motivational mechanisms that animate learning behaviors. In addition, attitudes and dispositions regulate one's stamina and attention during learning. These dispositions (Exhibit 2.1) have been termed *intellectual character* by researchers at Harvard's Project Zero (Ritchhart, 2002). Think of them also as a set of "studio habits" essential for individuals to develop in the service of the craftmanship of learning.

Exhibit 2.1 • Dispositions of Intellectual Character

- Curiosity
- Wondering/questioning
- Seek understanding (move through confusion, figure out the puzzle, or find the pattern)
- Remixing
- Be skeptical (noticing and naming contradictions/critical analysis)
- Press and recovery (focus, lean into learning, persevere, know when attention/focus wanes, provide brain recovery time)
- Metacognitive
- Develop learner craft

Sources: Claxton, 2017; Ritchhart, 2002; Seidel et al., 2022.

These dispositions are closely related to our emotions. Monitoring and managing them during learning can help manage the anxiety that arises when feeling confused or stuck.

Why does it matter? Attitudinal dispositions are like turning a car ignition. The key in the car's ignition doesn't make the car go. The engine does, but without igniting it, the car will never get started. That one action sets off a chain reaction under the hood, sparking different parts to interact and start the engine. That's what a student's feelings about learning, levels of motivation, and self-belief do.

The attitudinal and character dimensions of cognition are not captured in traditional approaches to accelerated learning and rigor. One of the most observable differences between independent and dependent learners is their disposition toward learning and their inclination toward cognitive action.

What's the equity connection? In the current orientation to schooling, we assume that certain student groups come to school with no inclination to build intellectual character and must be taught these dispositions and habits. Looking at this through a culturally responsive lens, we recognize that all people in all cultures build an intellectual identity in their children. Cultivating and nurturing these dispositions are grounded in one's cultural and linguistic community traditions. Unfortunately, the ability to express and grow one's intellectual identity in certain contexts is constrained by dominant narratives that seek to "other" diverse students.

In most Western societies with a history of colonization, there is a bias toward individual pursuit, often connected with grit and striving for external rewards. In most collectivist cultures, even within the diverse expressions of collectivism, there is a common orientation to cultivating and nurturing these dispositions through collective community practice.

How does this help disrupt the cognitive redline? As we noted in Chapter 1, undermining the confidence of young learners is a key tactic of inequity by design mechanisms in schools. When students are exposed to dominant narratives about low intelligence of the racial, linguistic, ethnic, or socioeconomic group they belong to, it erodes their confidence as a learner. Dr. Bettina Love (2017) in *We Want to Do More Than Survive,* calls this "spirit murdering." Dr. Mica Pollock (2017) highlights the way these narratives are allowed to thrive in many schools' teacher lounges and in professional learning community (PLC) meetings in *SchoolTalk: Rethinking What We Say About—and to—Students Every Day.*

When we help students reframe their learning challenges as growth opportunities rather than some confirmation of low ability, they begin to reclaim their confidence and reset these internal dispositions that motivate, activate, and direct cognitive behaviors. This reset offers a protective element that helps students become more resilient in the face of productive struggle and resistant to dominant narratives that seek to keep them from moving into their zone of proximal development. As result, they are ready for the rigors of productive struggle in the elaboration phase of information processing.

3. **A good information processor constructs and reconstructs a set of flexible internal cognitive moves and routines that enhance the meaning-making phase of information processing.**

What is this? Where dispositions focus attention during the first stage of the information processing cycle, cognitive routines move content along to the next phase. Elaboration happens in the working memory when the brain turns information into usable knowledge. Some like to describe working memory as a "cognitive workbench." Working memory is a place where the brain temporarily stores new content so it can be "chewed" during productive struggle. This is where the student is manipulating the information from a lesson using flexible internal cognitive routines to mix new content with existing funds of knowledge.

Earlier, I used the analogy of digestion to describe elaboration or cognitive chewing. We depend on several physical movements to process food. Our teeth, tongue, saliva, esophagus, stomach acid, and so on move food through our system, each step of the way breaking it down and remixing it to make it usable for the body. Just as chewing prepares food to be turned into nutrients, cognitive moves mix new content with our background knowledge.

Why does it matter? The more background knowledge you create, the more effectively and quickly you can convert the content in a lesson into usable knowledge. This capacity matters because without it, students cannot generate more learning power. During elaboration, they build their capacity to see patterns and connections, moving from surface-level understanding to deeper, more abstract relationships between concepts.

These routines and structures are the power plant of rigor and stamina. It is important to remember that engagement and effort are directly affected by stamina, which comes from the ability to reconstruct and expand one's cognitive structures and the mental operations that make learning less effortful. Ironically, this leaves the student with more bandwidth to take on a heavier cognitive load that will require more effort.

What's the equity connection? When we look at this capacity through a culturally responsive lens, we keep in mind that how we go about learning new things is shaped by our cultural orientation along the continuum between **individualism** and **collectivism**. For young people of color, the ways they make connections and manipulate their internal mental operations are shaped by how collectivist learning practices have been structured in their community. Supporting and coaching students to build and strengthen their cognitive structures means disrupting current practices that restrict opportunities for students to construct and reconstruct internal operations that work for them yet may not fit the current grammar of schooling and its pedagogy of compliance.

How does this help disrupt the cognitive redline? As I have said before, developing cognitive structures and mental operations for dependent learners is what is required for them to become cognitively independent learners. Building, practicing, and strengthening these flexible internal cognitive moves and routines is what allows the students to close their learning gaps over time. Without these skills, students remain dependent on the teacher to do the cognitive chewing in the classroom. When developing these learn-how-to-learn skills is the focus of Tier 1 instruction, we see students able to accelerate their learning.

4. **A good information processor uses external and internal feedback loops to monitor and adjust their learning tactics.**

What is this? The brain is a learning machine. That's its prime directive. To continually expand its learning capacity and background knowledge, it uses every learning episode and every experience to refine its information processing capacity, even those times when we struggle or get things wrong. It extracts information about what got the desired result and what failed to get the desired result. Then, often in real time, it will restructure, reconfigure, revise, and update cognitive routines to become more efficient the next time around. The brain does this using internal and external **feedback loops** to monitor itself.

A good information processor uses failure, errors, and setbacks as information about what needs to be adjusted to improve future efforts. The more the brain improves its information processing skills, the more it can generate its internal feedback loops. As a result, the learner requires less explicit **scaffolding** from the teacher. The student begins to move toward becoming self-directed.

We typically associate feedback with assessments, testing, and grading. But feedback loops are an integral part of learning, especially within the information processing cycle. These loops—taking in data, evaluating the data, and adjusting based on the data—are required for the most important part of the information processing cycle—elaboration. A good information processor knows how to interrogate their learning with a gap analysis. Internal feedback begins with asking questions such as the following:

- How do I get from where I am to where I want to be?
- What needs to change to increase my skill or understanding?
- How well am I grasping this concept?
- Where are my leverage points for adjusting my learning tactics?

The ability to monitor one's learning and to self-assess is essential.

Why does it matter? Processing new content effectively to get to conceptual understanding requires us to move through a cycle of active learning, pausing to step back and assess if things are going in the right direction, and then using that information to make adjustments before resuming active learning. This cycle is the internal feedback loop critical to becoming a good information processor. Feedback loops give you the information for self-correction. It sets the stage for deliberate practice—if you don't know where you're missing the mark, then you don't know what part of a process or skill to work on.

What's the equity connection? To become leaders of their own learning, students need to be self-aware of what is and isn't working in their learning process. Being able to access and use one's own internal feedback is key to interrupting dependent learning and being able to level up one's learning. The more students learn to use feedback data to make in-the-moment adjustments, the better positioned they are to increase their learning power.

How does this help disrupt the cognitive redline? Helping students become skilled at using feedback disrupts the cognitive redline by reducing their dependence on the teacher to direct their learning. Mastering this aspect increases a student's sense of agency. As students become better at monitoring their learning and making effective adjustments, the more willing they will be to let go of learned helplessness and other dependent learning behaviors.

5. **A good information processor can recognize, name, and regulate the emotions of cognition before and during learning.**

What is this? Emotion and cognition are deeply interwoven in the fabric of the learning brain. When we are engaged in the active elaboration phase of information processing, we have to simultaneously manage the emotions of cognition: confusion, contradiction, frustration, self-doubt, as well as surprise and elation that come from having an "aha!" moment when something confusing begins to make sense.

Good information processors can notice and regulate their emotional state during each phase of learning—reducing anxiety when confused, managing growing frustration when hitting roadblocks, mustering up more effort when tackling a hard task, and knowing how to cycle down to replenish one's stamina. They know how to get and keep their brain calm and ready for learning. In addition, the learner is able to manage negative self-talk about ability, identity, and aptitude to keep self-doubt at bay. When students are taught how to manage their emotions, a brain state of **relaxed alertness** can be self-generated. A good information processor understands what gets them into the social-emotional flow for learning.

To counter self-doubt and negative narratives, good information processors employ a set of internal counternarratives and positive **attribution** that may or may not match the messaging and actions in the classroom dominated by a pedagogy of compliance. They stay positive in the face of confusions, contradictions, and frustrations during learning.

Why does it matter? Managing and protecting one's learner identity in the classroom environment is important, especially for historically marginalized students whose racial, linguistic, and cultural identities lead others to call their motivation into question. In order to ensure that the amygdala will allow the brain's prefrontal cortex and other regions to engage in information processing, a learner has to also regulate their emotional state to keep cortisol levels in check. If the amygdala detects high stress, it diverts energy and focus away from learning into fight, flight, or freeze mode for self-protection.

How we react to frustration, confusion, or self-doubt in the face of challenge determines the force and intensity of one's ability to move through their information processing cycle.

What's the equity connection? When we look at this capacity through a culturally responsive lens, we know that students' sense of positive identity development positions them to manage the emotions of cognition more effectively. Through cultural affirmation, they reject the idea that negative expressions of emotions like anger or even cultural expressions of joy in some way confirm stereotypes about people from their linguistic or racial group. In the past, these narratives have been used in subtle and overt ways to discourage students of color by suggesting they lack self-control or are volatile and must be more closely monitored to keep them in line.

How does this help disrupt the cognitive redline? The student disrupts these common tropes with counternarratives that align their strong learner identity with their racial, linguistic, and cultural identity. They draw on the rituals, routines, and mantras about learning from their culture and community.

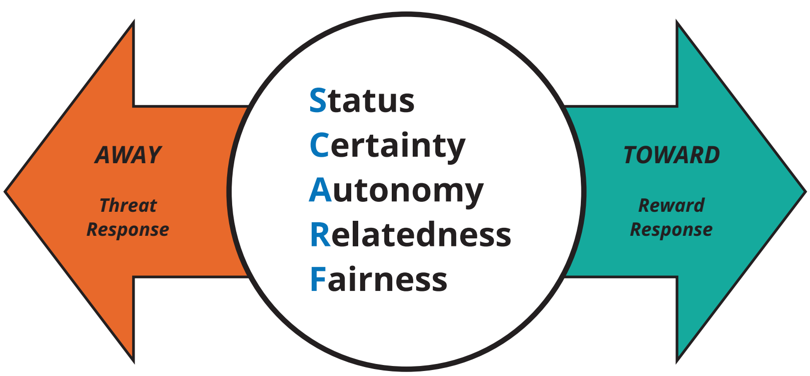
6. **A good information processor navigates the social context and physical environment to regulate focus.**

What is this? Through each phase of the information processing cycle, the brain navigates potential threats to its attention from social, emotional, and physical distractions. The amygdala's partner, the **reticular activating system (RAS)**, scans the environment to determine if it is safe to enter a state of what Caine and Caine (2015) call *relaxed alertness*, Cal Newport (2016) calls *deep work*, and Mihaly Csikszentmihalyi (2009) calls *flow.*

Good information processors use information from their social context and from the physical environment to establish intellectual safety so they feel they can be vulnerable while they engage in productive struggle. They learn to activate their vagus nerve's **neuroception** to "read the room" to assess the level of social and intellectual safety that makes it okay to go into information processing mode, which requires a great deal of focus. Good information processors learn to shield their active processing from distractions in the environment. In addition to psychological safety, the RAS is also scanning the physical environment regularly to manage physical comfort—too cold, too hot, or too quiet, too noisy—so internal thermostats can be adjusted.

Why does it matter? Psychological safety is a prerequisite for deep learning. The brain's primary emotional safety monitor, the amygdala, determines if the brain can relax its aggressive RAS scanning and instead shift its energy toward information processing (learning). The amygdala has tasked the RAS with scanning across five major domains of safety for threats or rewards: **status**, **certainty**, **autonomy**, **relatedness**, and **fairness**. David Rock (2020) summarizes these into the acronym **SCARF** (Figure 2.7).

Figure 2.7 • Definition of SCARF



What's the equity connection? Looking through a culturally responsive lens, we understand that historically marginalized students also scan their learning environment for safety from racial profiling and racial bullying. In addition, they are scanning for similar collectivist learning structures and processes, including talk structures, distributed knowledge sharing, and the integration of verve. In a learning context, "verve" refers to the enthusiasm, energy, and vigor that someone brings to the learning process. It describes an animated, spirited approach to acquiring knowledge or skills. The brain wired around collectivist practices seeks a physical environment that allows for some movement as well as opportunities for tapping the distributed expertise of others periodically.

How does this help disrupt the cognitive redline? An identity-safe classroom (Cohn-Vargas et al., 2020; Talusan, 2022) happens when teachers strive to ensure that students' social and cultural identities are leveraged as assets rather than looked on as barriers to success in the classroom. Acknowledging students' identities, rather than trying to be colorblind, can build the foundation for strong positive relationships. Psychological safety positions diverse students for optimal learning. Students' ability to navigate the social dynamics in the classroom directly affects their ability to stay in a state of relaxed alertness and engage in deep learning; otherwise, our most vulnerable students may succumb to stereotype threat, which kicks off a cascade of stress hormones and self-doubt. This is what cognitive redlining does to keep students off balance and in check.

These six components are not an exhaustive list of the skills and capacities students need to be college and career ready by the time they graduate. Instead, they are gleaned from social and cognitive neuroscience as some of the essential building blocks students need to grow their learning power to the point where they have agency over their learning. I am sharing this framework because I learned the hard way when I was in the classroom that I cannot help my students become better writers if I do all the cognitive work for them. At the time, I didn't know how to help, but in my gut, I knew it wasn't ethical to just leave them to figure it out for themselves. The educators I support during their professional learning express frustration with not knowing how to help students build their learning power. As we move through the remaining chapters, you will learn the process for building your own capacity to coach students around the development of these powerful skills.

Making the Shift Happen

The chapter argues that to disrupt cognitive redlining and achieve educational equity, we must develop each student's capacity as an information processor rather than just solely focusing on belonging, motivation, or engagement. That requires a deeper understanding of the brain's information processing system and how it differs from executive function.

Improving the six capacities of a good information processor leads to increased learning power, helping students become cognitively independent learners.

Assess Current Reality

- In grade-level, department, or PLC teams, study the gap between your school's equity vision and current instructional practices that develop or limit students' information processing capabilities.
- Map the "equity zone" in your classroom. Identify how often historically marginalized students are being supported to work in their zone of proximal development versus being kept in their comfort zone.
- Audit classroom environments for psychological safety factors that support "relaxed alertness" necessary for deep learning, especially for students from collectivist cultural backgrounds.