Introduction

Activating Student Thinking

As I entered the classroom I immediately noticed the bustle of high energy and positive chatter. I couldn't find the teacher in the midst of the focused activity that was evident. Students were not in rows but in clusters of two or three, discussing and working together. I found the teacher engaged with a small group, questioning, suggesting, and giving specific feedback so students could proceed. I eavesdropped on several groups and asked questions myself; the students were very clear about what they were trying to accomplish, some of the roadblocks they had overcome, and what they would do next. As I scanned the room, the students were generally self-directed and productive, using technology seamlessly as needed . . . tablets, computers, cell phones.

Of course all this didn't just happen. The teacher had orchestrated it with careful planning and excellent classroom management. Materials were organized, charts showed expectations related to standards, and students had rubrics with success criteria to guide their success. These students were not recipients of knowledge; they were constructing it, monitoring their progress, and taking responsibility for their learning. This teacher had successfully activated the *thinking* in this classroom. How did she do it? What were the strategies used to turn these students into active, thoughtful learners?

THE TEACHER AS ACTIVATOR

This book is about all the ways that teachers can activate student learning. But when we use the phrase "activate student learning," what do we really mean? There is no single switch for learning but skillful teachers have discovered over time what will activate their students' learning. To activate is to cause to act, not to sit passively listening and writing down notes.

The reticular activating system (RAS) in the brain is vital to the ability to attend to and ultimately filter new information and experiences. The RAS helps us engage our curiosity and interest in meaningful opportunities. Some things will inhibit the engagement and activation. One is the learning environment. Some things are already innate in the learner to help with the activation issue, primarily, the SEEKING system.

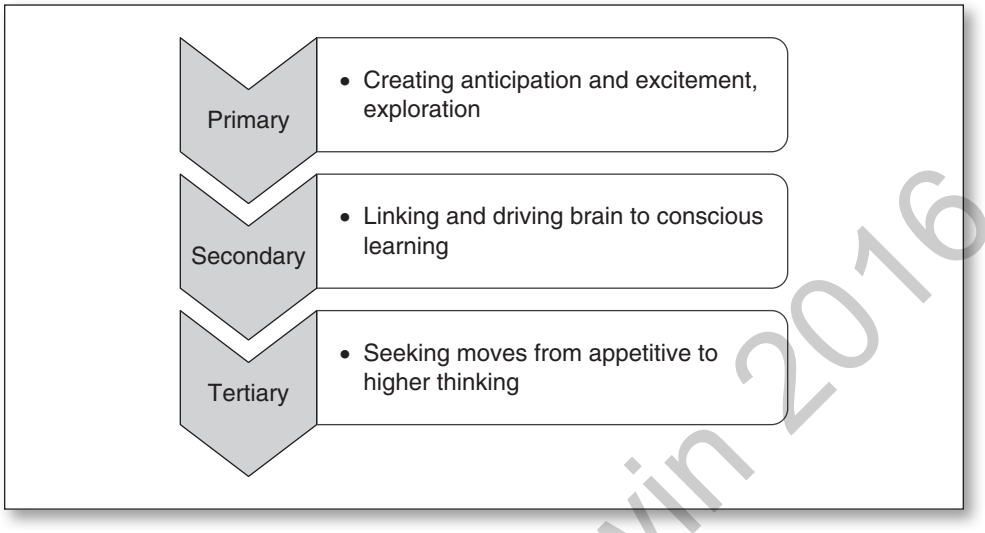
THE SEEKING SYSTEM

According to Jaak Panksepp (1998), humans have a natural SEEKING system (always printed in uppercase by Panksepp). By studying the emotions of other mammals, Panksepp determined there are seven basic, primitive emotional processing systems found in the oldest area of human brains. These are primal levels and help us understand what we currently define as motivation. Panksepp calls the most powerful of the seven systems the SEEKING / EXPECTANCY system, which includes *curiosity, interest, foraging*, *anticipation*, and *craving*.

This is a primal survival system in all of us. The other systems are FEAR, RAGE, LUST, CARE, GRIEF, and PLAY. Panksepp emphasizes that the SEEKING system is the granddaddy of the emotional systems and will naturally engage and activate exploration, experimentation, and thinking from the learners' innate need to know and understand (Gregory & Kaufeldt, 2015). This critical primary emotion is innate and important for humans to connect, cooperate, and collaborate. It keeps people motivated and interested in examining the world for survival and learning. It is vital for survival and is there for all teachers use as a motivational tool. Educators can activate their students' SEEKING system and allow it to flourish by providing them with opportunities to explore, examine, and play, and also by offering them strategies they enjoy plus metacognition related to learning and success. Thus it helps generate enthusiasm and release dopamine in the brain as we SEEK. The dopamine is not so much a reward as a motivator, providing a sense of eagerness to continue. The dopamine release and resulting euphoria occur during the foraging process, not at the end result. This keeps us intensely involved in the process. It is the expectancy of completion and a sense of "wanting" that creates conditions for continued attention to the task. When the exploring is complete there is a brief squirt from the opioid system (liking) that is actually less significant than the ongoing dopamine release as we SEEK. There are three basic processing levels in the SEEKING system as seen in Figure I.1.

The primary SEEKING process is "appetitive" and related to expectancy. This is the initial phase of SEEKING; as we forage and explore we

Figure I.1 The Three Levels of the SEEKING System



create curiosity, anticipation, and enthusiasm and constant dopamine release that keeps us motivated. This is unconscious and emotion-driven and is referred to as *anoetic consciousness* (or without conscious knowledge of what is occurring). There is no higher-order thinking or reflection. In young children this is spontaneous play.

When the secondary processing system kicks in, there is conscious thought process or *noetic consciousness* including awareness and knowing. It is at this point that we are aware and real learning begins. We make connections from prior knowledge or to our own reality and anticipate next steps related to the exploration phase. If we have had previous pleasure or success we are "wanting" to seek that again. This stage includes active processing or practice to become proficient and grow dendritic connections between neurons through repetition. Thus memories are made. We can foster this phase by providing an enriched environment of resources, multisensory, and interesting activities. Hebb (1949) suggests that neurons that fire together will wire together and thus form memories. Brain growth is dependent on the interaction among genes, the environment and quality experiences.

The third level of processing develops with maturity. This level of processing is evident when the learner can think beyond the present and is able to create, imagine, and synthesize information and use it in a productive way to solve problems and make plans (Panksepp & Biven, 2012). This more complex thinking is referred to as executive function, which includes ability to consciously control thinking and to self-regulate. Multiple opportunities are needed to continue to develop executive function

through asking learners to apply knowledge and higher-order thinking through the use of projects and problems (Gregory & Kaufeldt, 2015).

For the last number of years educators have talked about teachers moving from the "sage on the stage" to the "guide on the side," from lecturer to facilitator. Professor John Hattie (2009) now suggests that facilitation is not enough. He recommends that we distinguish between the roles of *facilitator* and *activator*. Facilitation is only the guide on the side, but activation means being integrally involved with students as a partner in learning. This also implies a new learning relationship between and among teachers and students. Not an I/You but a We.

How does facilitation contrast with activation in practice in the day-to-day classroom? Hattie gives some examples. In classrooms where the teacher acts as a facilitator, you might find gaming and simulations, inquiry-based activities, smaller class sizes, problem-based learning, individualized instruction, and web-based and inductive teaching. In classrooms where the teacher acts as an activator, you might find reciprocal teaching, teacher-student self-verbalization, metacognitive strategies, appropriate level of challenging tasks, and checks for understanding, feedback, and effectiveness. Figure I.2 shows these strategies in greater detail. The impact of teacher as activator has an effect size of 0.60 and that of teacher as a facilitator is only 0.17.

This book gives teachers a chance to learn about the high-impact strategies that are most effective according to Hattie and others, and it also offers practical ways to put these strategies into our daily work in classrooms and schools. Although research is helpful and promising, we need to operationalize the research so that teachers can use it in the classroom. Educational neuroscience has and will continue to inform our practice and cause us to question past methods and engage in new

Figure I.2 Teacher Facilitator and Activator Strategies

Facilitator	Activator
• Providing games and simulations • Problems and projects • Attention to gender issues • Online learning • Whole language programs • Inductive and inquiry methods	• Peer interaction and teaching • Quality feedback • Fostering self-reflection and metacognition • Using direct instruction • Attention to mastery • Appropriate level of challenge • Thoughtful assessment and evaluation methods

Source: Hattie (2009).

ones to better serve our diverse students. Brains have some similarities but also some unique characteristics. All this should take place, of course, in a climate of safety and invitation where errors are accepted as a part of the learning process. The environment should also be welcoming and nurturing.

Making a shift from facilitation to activation doesn't require hefty funding or output, the way new textbooks or computers would. It just requires a mind shift about what we believe schools should be like—changing our vision from a factory model to a thinking model. Here are some of the factors in education that need to be changed for students to be activated and reach their potential.

CHANGING SCHOOLS

Many schools have not changed much in the last century. In a lot of classrooms the teaching mode is still "sit and get." It becomes even more that way as we move up the grades with the guise of getting the student ready to handle college or university (even though many may have no intention of attending university and enduring long lectures). Teachers continue to rely on "talk and chalk" (or perhaps "talk and overhead" or PowerPoint) methods, and we expect students to endure it. Some teachers even suggest that if it was good enough for them when they were in school, it's good enough for their current students.

Teachers always find that there is a group of compliant learners in a class who learn in spite of us. They will do whatever it takes to graduate at a high level. They are somewhat self-sufficient, self-starters who follow routines and expectations and succeed whether learning is engaging or interesting.

But times are changing, and we now want more than a measly quarter of students—those on the high end of the bell curve who are highly internally motivated—to be successful. From No Child Left Behind to Race to the Top, expectations are that *all* students can and should do well. We should no longer blame failure on the students' lack of commitment and perseverance. If students are not committed, it's often because they are confronted with a boring and unchallenging curriculum filled with "drill and kill" assignments and preparations for test taking. Surveys of thousands of teachers from all grade levels as to the level of enthusiasm in their students garnered interesting information. About 95% reported teacher satisfaction with their students' enthusiasm at the kindergarten level, but that satisfaction plummets to 37% by ninth grade. Research sponsored by the MetLife Foundation (2012) showed a downward trend in

teacher satisfaction as well, from 54% to 40% or even less. So we are losing hearts and minds of both our students and our teachers.

How can we turn this around? Cognitive scientist Daniel Willingham in the book *Why Don't Students Like School?* (2009) proposes that students don't like school because teachers don't understand the brain and therefore don't teach as well as they could. We have had over 30 years of neuroscience discoveries that we should be paying attention to, because after all it is the brains of these learners that are our main area of concern. Marian Diamond years ago suggested that all educators needed to know and should want to know how brains work. Lesley Hart (1983) stated that a teacher who doesn't know how the brain works is like a mechanic who doesn't know how engines work. Willingham likewise suggests that students could love school if we would use what we know about brains to plan learning. Currently, he suggests, school is more like prison. The only difference is the school is age mandatory and to get into school prison you don't have to commit a crime.

In the early years in elementary schools we are much more brain friendly, consciously or unconsciously. But as children move up the grades there is less and less movement, spontaneous application, novelty, fun, exploration, and autonomy. Students become less and less engaged and actively involved and often only endure passively in classrooms. The fact that many children don't like school is not because it really is a prison; it's because the "wardens" may not keep the students' minds activated. And it really isn't that hard to do.

It all comes down to student engagement, activating thinking, and challenging students just beyond their zone of proximal development.

CHANGING INSTRUCTIONAL STRATEGIES

Outside of the traditional classroom the world is rapidly changing. This millennium generation is living and learning in the information age, and students need to know how to access information and be practical, analytical, and creative with it (Sternberg, 1996). Students' brains are not the same either. The technology-rich, fast-paced real world is far more engaging than many classrooms. Schools are competing for attention and engagement with the digital world. Students will appreciate classrooms where there is more interaction, discussion, and *doing* with problem/project-based, hands-on application, creativity, and deep learning. There is a large evidence base of proven instructional strategies that not only activate and engage students but also increase student achievement. Teachers who use these strategies will be more engaged as well.

> Not all teachers are effective, not all teachers are experts, and not all teachers have powerful effects on students. (Hattie, 2009, p. 34)

In order to make the shift to activated learning, teachers also need different types of support. Current teacher evaluation is usually based on their students' test scores, and that is not the message we want to send when we are endeavoring to encourage educators to take some risks to change practice and collaborate to unearth better approaches for all learners.

> Educational change depends on what teachers do and think—it's as simple and complex as that. (Sarason, 1971, p. 193)

Therefore it is imperative that we help activate teachers and students *together* to become passionate learners. Teacher skills need to move beyond current evidence-based instructional strategies and learn to be "instructionally intelligent" (Bennett & Rolheiser, 2001). They need to know how to match strategies to content, skills, and student preferences; to know when learning has been achieved; to experiment and adjust strategies as needed; and to seek and give feedback in professional learning communities.

CHANGING CURRICULA

Madeline Hunter (1967) suggested years ago that if we are just going to "cover the curriculum" we might a well just dig a hole and bury it. Unfortunately there is a lot of "covering" going on in classrooms because of the demands of standardized testing. If we were to spend only 30 minutes on each K–12 standard we would need nine more years of school simply to review each standard (Marzano, Pickering, & Pollock, 2001). Marzano's suggestion is to concentrate on *power standards*—those enduring subject areas whose relevance has stood the test of time (McTighe & Wiggins, 2013; Ainsworth, 2003a)—and to go deeper to develop major concepts so that real long-term deep understanding takes place. When deep learning takes place, a lot of the other standards will be subsumed and understood simultaneously. Meaningfulness and relevancy are important to the brain and learning something "because it is on the test" does not engage the brain the way connecting learning to their lives would.

In day-to-day dealings with students, teachers might be overwhelmed and frustrated with the different levels of readiness, preferences, and interests that students have (Gregory & Chapman, 2013). When faced with the momentous task of differentiating instruction for

students with various skill levels, some teachers may project the problem onto the students and may even unconsciously believe that some students just can't achieve. But students aren't the problem. Every student can learn and flourish if the curriculum activates their engagement. Here is what we know:

- Social class/prior achievement is surmountable. It has little impact on student success.
- All students can be challenged. Differentiation meets students where they are.
- Strategies, not styles, make the difference. Mixed modality strategies benefit all learners.
- Students flourish under high expectations.
- Coaching is important. Success follows when we monitor student progress and encourage students to seek help when needed.
- Students can learn to self-assess. They need to know where they are in relationship to the target so they can plan what to do next.
- Peer interactions and social support works.
- Feedback is the breakfast of champions. Critique and feedback are powerful.
- Self-regulation and seeing students as teachers is key. Students need to know, "If it is to be, it's up to me."

CHANGING LEARNING VISIBILITY

John Hattie in his work with visible learning suggests that teachers need to *see* learning through the eyes of the learner and students need to *see* themselves as teachers. In other words students take an active role in the learning process, identifying and setting goals, and planning and assessing their progress toward their goals.

Over the course of his 15 years of research Hattie synthesized over 1,200 meta-analyses (and counting) and described what most influences K–12 student achievement. This research included over a quarter of a billion students and is the largest collection of evidence-based findings of what is promising to improve learning. In his books he shares what one needs to pay attention to in order to achieve success for teachers and students. Three things stand out: clear and challenging learning expectations, making success overt and visible, and using learning strategies that develop conceptual comprehension for teachers and students.

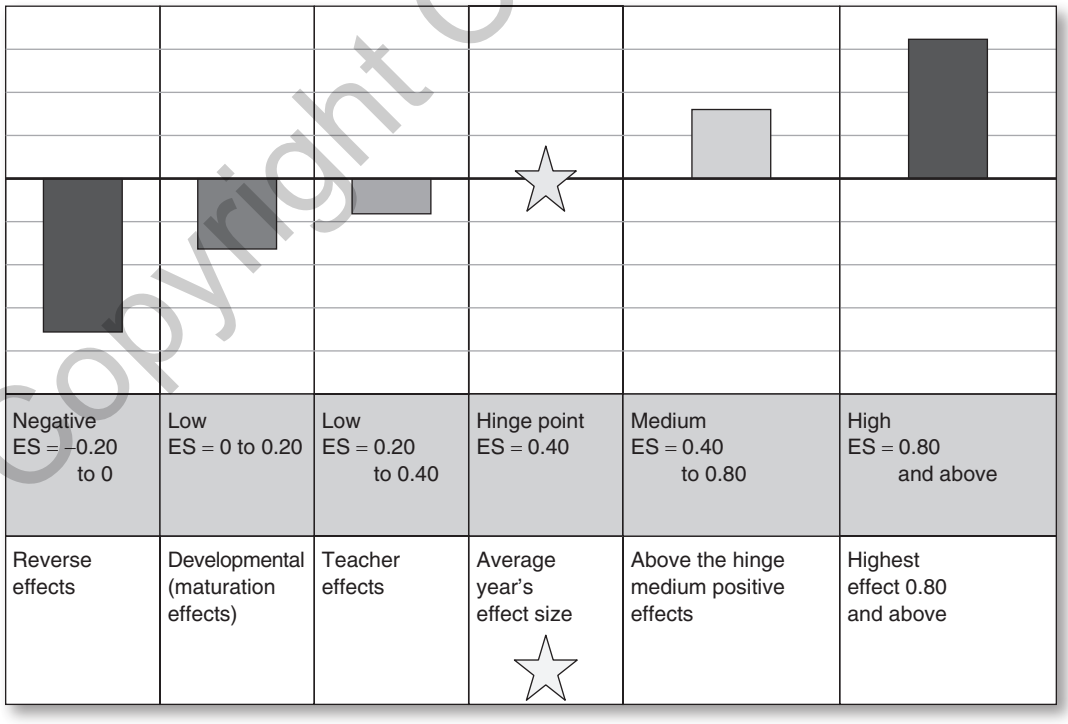
Hattie uses a baseline of 0.40 standard deviation growth in a school year—this is the "typical effect" hinge point recommended (Hattie, 2009).

With no instruction at all (just life experience) the average student's academic achievement will increase yearly by 0.10. He also found that if a teacher possesses an average level of competence, then an average student's academic achievement would increase by 0.30. With these two factors combined, the average student will improve by 0.40 a year simply by living and experiencing average schooling. In other words, with little intervention and random placement, 0.40 is what we can expect. However, to improve beyond that we need to seek out practices that have a higher than 0.40 impact. Figure I.3 illustrates the possibilities.

> What is most important is that teaching is visible to the student, and that the learning is visible to the teacher. The more the student becomes the teacher and the more the teacher becomes the learner, then the more successful are the outcomes. (Hattie, 2009, p. 25)

We know that we want to get above the 0.40 hinge point. But what strategies will get us there? Hattie analyzed and ranked 150, and counting,

Figure I.3 Above and Below the Hinge



Source: Based on Hattie (2009).

influences on student growth, and he assigned each influence to one of six potential factors: the child, the home, the school, the teacher, the curriculum, and the approaches to teaching.

1. Hattie reminds us that **children** bring to school factors that influence achievement from nature (genetics) to nurture and personal dispositions that influence their school success.
2. Students are either supported by a positive **home** or hindered by a destructive one. Positive expectations of parents are critical to student success. They need to be involved and supportive and help develop the child's love of learning. It takes a village to raise a child.
3. The **school** effects include the climate of the classroom and peer influences that are embedded in the culture.
4. **Teachers** are a critical factor in terms of their expectations, quality of teaching, openness, classroom climate, clarity, encouragement, and engagement of students.
5. The **curricula** should offer a balance of surface and deep learning and should allow students to construct meaning with multiple opportunities for practice.
6. **Approaches to teaching** includes setting goals, identifying criteria for success, fostering student involvement, direct instruction, group work, technology, and out-of-school learning.

Hattie's research suggests that school has the most powerful effects by creating the most nurturing climate in the classroom, fostering peer influences, and minimizing the instances of students' disruptive behavior. Teachers also set the stage with their own expectations, their teaching and openness to students. Most critical, though, is the quality of the teaching through the students' eyes.

CHANGING THE FACTORS THAT MATTER MOST

In this book I've tried to start small and think big and will examine the most promising domains those that have moderate to high impact with effect sizes greater than the hinge point of 0.40. The complete rank order and extensive list of these effect sizes may seem daunting to a classroom

teacher. But many of these can be clustered and linked together and are mutually supportive, as you will see throughout the book.

Group 1: Classroom Climate

This first grouping is crucial in developing a brain-friendly learning environment where students can feel secure, are supported, and thrive. All domains are beyond the hinge point with moderate to high impact.

- Self-efficacy related to learning: 0.80
- Developing teacher–student relationships: 0.72
- Classroom and student behavior: 0.68
- Eliminating labeling students: 0.61
- Classroom management—routines and expectations: 0.52
- Teacher expectations for students' success: 0.43

Group 2: Collaboration and Peer Support

It makes sense to focus on several domains together to develop peer interaction and facilitate dialogue in the classroom to activate a collaborative community.

- Class discussion rather than teacher monologue: 0.82
- Reciprocal teaching between and among students: 0.82
- Cooperative learning vs. individualistic learning: 0.59
- Peer tutoring: 0.56
- Collaboration vs. competitive learning: 0.54
- Peer influences toward positive climate: 0.53
- Cooperative group learning: 0.42

Group 3: Teacher Qualities

The qualities and expertise of teachers have a great impact on student success. The teacher does indeed make a huge difference by attending to a variety of high impact strategies and continuing to develop the knowledge, skills, and dispositions that make a difference in student learning and achievement.

- Teacher credibility: whether or not the teacher comes across knowledgeable, capable, and respectful: 0.90
- Teacher clarity in providing information, expectations, and worked examples in student language: 0.65
- Teaching strategies (instructional repertoire that varies instruction): 0.62

Group 4: Assessment and Feedback

Being clear about the learning intentions, offering quality feedback, and fostering metacognition are key to developing assessment-capable learners, all of which teachers can foster and nurture in their classrooms.

- Student self-report grades related to clear goals and students are assessment capable learners using assessment to progress: 1.44
- Providing formative evaluation: 0.90
- Feedback provided from multiple sources, teachers, peers, and self: 0. 75
- Metacognition and self assessment considering their work and progress and redirecting as a result of reflection: 0.69

CHANGING OUR DEMEANOR: THE IMPORTANCE OF PASSION

It is not a crime to be joyful and emotional about learning. Yet by doing so teachers may be regarded as trivial and lacking cognitive focus and seriousness about learning (Neumann, 2006). Passion includes the sheer thrill of learning, a deep commitment to the process and the sensations and willingness involved in their experience. Passion is infectious and transferable and can be modeled and taught. Young children seem able to express passion and the thrill of learning. They exude joy when involved in the challenge of developing new skills and knowledge (Willis, 2007). It is amazing to see the passion and joy that is obvious at 7 or 9 years of age, whether it's discovering a new gymnastic routine, swimming dive, Tai Kwon Do technique, reading a challenging chapter in a book, or demonstrating a new skill in the kitchen. Life provides endless challenges for us to engage and persist in a new ability until we achieve mastery. Children are tenacious in their quest. It doesn't take much to activate their learning and SEEKING systems.

Doug Reeves (2002) suggests in these challenging economic times where resources for schools are scarce that passion is the commodity that is natural and renewable. Learning isn't always easy or pleasurable for that matter, but with deliberate practice and concentration one can meet challenges and achieve success.

CHANGING OUR MINDSET

Henry Ford famously said that whether you think you can or think you can't, you're right. And research since his time has only solidified the

notion that expectation is everything. World-renowned Stanford University psychologist Carol Dweck (2006), after years of research, developed a perspective on expectations that backs this up. Everyone has beliefs about their potential and capabilities. People attribute their achievement or lack of achievement to mindsets or beliefs that they hold about themselves and their own personal qualities. Dweck identified the two basic mindsets that people have related to their abilities: a *fixed mindset* and a *growth mindset*.

Those who have a fixed mindset believe that they (and others) are born with certain capabilities—IQ, talent, resourcefulness, and so on—and that those don't change. Students who have a fixed mindset tend to avoid challenges for fear that they won't be able to surmount them. Teachers who have a fixed mindset tend to label students based on their assumptions about how smart they think they are; they expect and foster success for some students and hold lower expectations and offer lesser and mediocre tasks for others.

People who have a growth mindset believe that everyone has potential for developing traits and skills and effort can change one's abilities. Students with a growth mindset believe that effort and "grit" is the path to mastery. Teachers with a growth mindset invest time and effort in their students and give students opportunities to try, redo, and choose alternate approaches until they are successful.

These mindsets are not cut and dry, of course. Dweck offers that students tend to fall into three groupings: 43% have fixed mindsets, 43% have growth mindsets, and 15% are undecided. Students' mindsets can vary dependent on the situation. Some have fixed mindsets to some aspects of school work (e.g., "I can't do math") but growth mindsets related to others (e.g., extracurricular activities such as playing hockey or learning the guitar). (See Figure I.4.)

As educators we have a powerful influence in the classroom and can help students activate and attain their potential. If we don't have a growth mindset, we excuse our students' failures by saying that they just don't get it instead of looking at the misstep as a challenge and developing new approaches. Our challenge as educators is to change minds: our own and the students', especially about who we are and what we can accomplish.

Dweck suggests that children have developed a mindset by the time they enter school; however, mindset can be influenced and activated by skillful teachers. Experiences such as learning new skills actually change our brains: Dendrites—the tree-branch-like bunches of cell that connect neurons—are known to grow and strengthen with practice. The way our brains change through experience is called neuroplasticity. It is proof

Figure I.4 A Comparison of Growth and Fixed Mindsets

	Fixed Mindset: Intelligence Is Static ***Desire to look smart, a tendency to . . .***	**Growth Mindset: Intelligence Can Be Developed** ***Desire to learn and a tendency to . . .***
Challenges	Avoid	Enjoy challenges
Obstacles	Be defensive, give up	Persist despite setbacks
Effort	Not be impressed by effort	See effort as crucial
Criticism	Ignore feedback	Appreciate feedback
Success of Others	Be threatened by others	Learn from others
Students . . .	Don't reach potential	Exceed beyond expectations

positive of the growth mindset (Diamond, 1967). This growth of brain connections is prolific in an optimum environment rich with activity, resources, multisensory appeal, and interactions in collaboration with others, all of which is engaging and satisfying to the brain (Greenhough & Volkmar, 1973).

This book represents an attempt to respect the natural neuroplasticity of our brains—to bring together all of the things that can activate learning and allow students to achieve success, despite their own expectations and the expectations of others. Using Hattie's research base of meta-analyses and our knowledge of neuroscience, the book will investigate the factors that most impact learning, including brain-friendly strategies and the all-important step of putting students in charge of their learning.

HOW THIS BOOK IS ORGANIZED

Chapter 1. Activating Classroom Climate

Chapter 1 focuses on the relationship between the latest neuroscience information that supports the need for a brain-friendly classroom—what has become educational neuroscience. An environment that supports how the brain operates is not simply "nice to have"; it is essential for individuals to thrive and survive. The antiquated notion of control, pressure, punishment, and one size fits all have been disproven by recent advances in brain science. Practical strategies are provided to orchestrate a learning environment that supports trial and error, risk taking, and collaboration, one that avoids undue stress and allows students to activate thinking and

continue toward self-regulation and success. Findings of classroom behavior with 0.68 effect size and classroom management at 0.52 as well as reducing anxiety 0.40 bear this out.

Chapter 2. Activating Teachers

It's about learning, not about teaching. But the teacher is key to activating and orchestrating quality experiences that enable learners to learn. Many attributes contribute to teachers being able to make the difference.

Chapter 3. Activating the Power of Peers

This chapter builds on the influence of peers in a supportive brain-friendly environment (ES of $d = 0.55$ from the meta-analysis). The neuroscience that supports this notion and how we as educators foster peer support and interactions in the classroom are included.

Chapter 4. Activating Cooperative Learning

One of the most highly researched instructional strategies, which unfortunately is not prevalent in all classrooms, is cooperative group learning. Students are often put in groups that fail to function well. As a result, there are classroom management issues and few academic and social gains, and teachers may eventually abandon the group format. These chapter reviews how to make cooperate learning really work.

Chapter 5. Activating the Power of Goals and Standards

Visible learning suggests that students should navigate their own learning experience using three key questions: Where am I going? How am I doing? Where to next? This chapter looks at the power of intentions and how we help students activate, monitor, and assess the process to success.

Chapter 6. Activating Assessment

Many classrooms and schools are data rich and information poor. Standardized testing provides lots of statistics, but they are not very helpful to teachers. This chapter reviews how to evaluate the whole student and how to give productive feedback (to both students and teachers) that will help them adjust the course and design the next steps. In this chapter the focus is "how are we doing" and "where to next" through collecting formative assessment including pre-assessment and ongoing checking for understanding.