9

Thinking Maps: Visual Tools for Activating Habits of Mind

David Hyerle

> Learners construct knowledge as they build cognitive maps for organizing and interpreting new information. Effective teachers help students make such maps by drawing connections among different concepts and between new ideas and learners' prior experience.
>
> —*Linda Darling-Hammond,* The Right to Learn *(1997)*

In early 1995, 4th graders at Friendship Valley Elementary School in Carroll County, Maryland, responded to a narrative writing prompt on the Maryland Performance-Based Assessment. The school had been built five years before on the principles of "the school as a home for the mind" and had strengthened its program through a range of high-quality teaching and learning strategies (see Chapter 19).

If you had been standing in a certain hallway of Friendship Valley on the morning of that test—normally a stressful few hours for all involved—you would have been startled by an ecstatic teacher running out of a room exclaiming, "They're using them on the test!" Many of her students, without coaching, had used Thinking Maps® to generate

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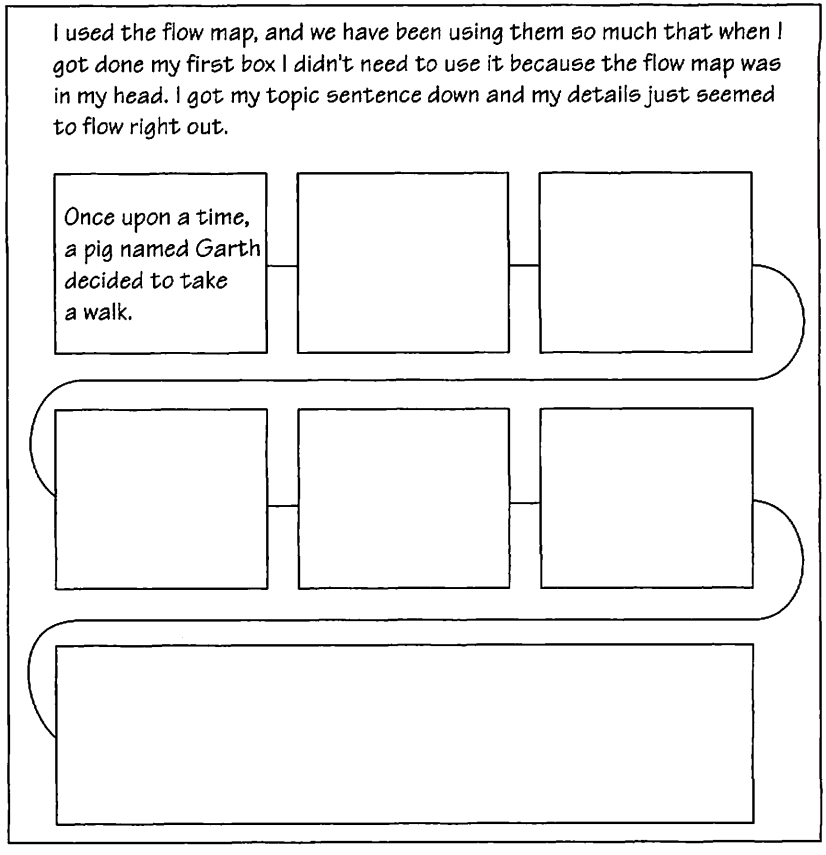
FIGURE 9.1
Student Flow Map



Source: Adapted from Hyerle, 2000.

and organize information to complete the prompt. After the testing documents were collected, the teacher asked students to write about strategies they used during the test. One student responded with a note and a flow map, one of the eight Thinking Maps that students had been taught (see Figure 9.1).

By the time the student and her peers sat down for the writing test, they were relatively fluent with using flow maps to direct and construct networks of knowledge on the way to final products. In addition, they had developed the disposition for creativity and flexibility. They were able to

persist, and they could call on a highly developed system for reflection and metacognition. In the end, these students' test scores were second across the whole state of Maryland on the combined scoring of six performance assessments—well beyond the mark where students in the school had performed previously. Exactly how was it that the student and her classmates, in the midst of a stressful test, were able to pull up a Thinking Map in their mind's eye?

Thinking Maps: A Common Visual Language for Learning

It is easy for us to recognize that carpenters, cooks, and computer programmers—and their mentors—have particular tools in hand for transforming raw materials into unique final products. The well-designed, efficient home, the thoughtfully placed array of items on the plate, and the user-friendly interface of a software program are engendered with both practicality and, in the most effective cases, artistry. Over their careers these craftspeople develop methods and strategies as they move from novice to expert use in these tools. They also develop an interdependent array of habits of mind that enrich their capacities to use the tools of the trade strategically, purposefully, and with a sense of design that often integrates mind, heart, and soul.

As we look into the classroom, though, we may ask: What are the tools of cognition for teachers to use to directly facilitate the *specific* thinking skills of apprentice learners so they move from being novice thinkers to expert thinkers and develop lifelong Habits of Mind? This is the animating question for this chapter. An answer surfaces from Linda Darling-Hammond's insight about how "cognitive maps" are at the intersection of effective teaching and improved student performance. In this chapter, we investigate a common visual language found in eight fundamental cognitive tools called *Thinking Maps*. This theory-embedded language offers pre-K to college students—as well as teachers, leadership teams, and business people—a coherent, consistent, and flexible model of visual tools for

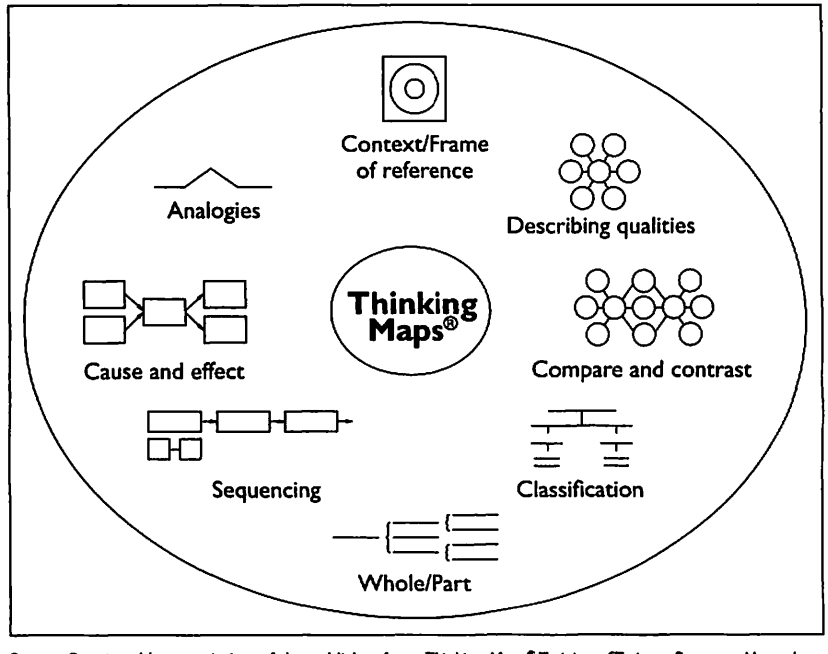
- *Representing* cognitive patterns as connected to prior experience and content knowledge.

- *Constructing* abstract concepts and practical products of thinking.
- *Facilitating* the full range of Habits of Mind within and across disciplines.

As shown in Figure 9.2, in isolation each of the eight Thinking Maps is grounded in a specific, fundamental cognitive process. When used together as a dynamic, interdependent visual language, these tools concretely support interactive teaching and learning, higher-order thinking and metacognition, and Habits of Mind across linear and nonlinear patterns of thinking. How is this different from most classroom practice? In a nutshell, most classroom practice *implies* cognitive skills instruction through "content" instruction, whereas use of Thinking Maps explicitly *defines and animates* such skills for students, so they become aware, cognitive actors in the classroom of learning.

FIGURE 9.2

Thinking Maps: A Common Visual Language



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The Visual Brain

The brain is capable of absorbing 36,000 images every minute. How can this incredible figure be true? It is because the sophisticated, front-loaded wiring of our brain system is well beyond our imagination. Research approximates that between 80 and 90 percent of the information received by the brain comes through the eyes. Though our auditory and kinesthetic modes of sensing are complex and integrated with visual processing, the dominant mode is visual. Such dominance may seem a radical departure from the idea that we need to somehow balance instruction across multiple modalities. Yet the reality is that the human brain has evolved to become positively *imbalanced* toward visual imaging for information processing.

Even if we believe that some individuals are more kinesthetic, auditory, or visual learners—or more global or analytic—we need to consider research showing that each of us still processes far more information visually than through other modalities. We must help students use their visual strengths.

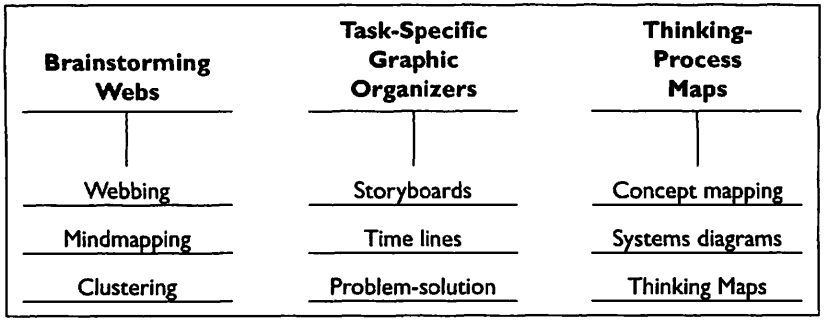
Visual Tools for Constructing Knowledge

Metacognition means thinking about thinking. It means knowing what we know—and what we don't know—and how we know that. Metacognition also refers to an awareness and control of one's cognitive processes and the regulatory mechanisms used to solve problems. Metacognition anchors strategies for students so that they can apply them in life situations beyond school.

When students represent their cognitive strategies with visual tools, they practice metacognition, a principle of learning in which they describe the thinking processes they use to organize content knowledge into patterns and to solve problems (Hyerle, 1996). Three types of visual tools aid this metacognition: brainstorming webs, task-specific graphic organizers, and thinking-process maps (see Figure 9.3).

As noted earlier, carpenters and chefs have particular tools for different operations; in much the same way, thinkers turn to different visual tools to activate certain Habits of Mind. In the examples that follow, we see that students can develop their capacities to be creative and flexible,

FIGURE 9.3
Types of Visual Tools



Source: Adapted from Hyerle, 2000.

to persevere, to be systematic, and to be aware of and reflective about metacognitive patterns to the degree that they can fluently apply these patterns to classroom challenges.

Visual tools enable students to look into their own thinking ("displayed metacognition" [Costa, 1991]), as they might look at their own reflection in a pool of water. With visual tools, students see their thinking displayed. From this public display, all students can readily share in one another's thinking and become self-reflective on the process, content, and, most important, evolving *form* of their thinking.

Brainstorming Webs

Although brainstorming webs appear in infinite forms, most learners start in the center of a blank page and branch out, creating idiosyncratic designs as an idea expands. The open form and purpose of brainstorming webs promote creative generation of ideas without blinders. Most brainstorming webs are used for thinking "outside the box," and they spark a high degree of open-ended networking and associative thinking.

After students become fluent with webbing, or with Tony Buzan's more specific techniques called Mindmapping™ (Buzan, 1994), it becomes clear that a cluster of intelligent behaviors, centered around creative thinking, is actively engaged and facilitated. Although educators have found it easy to identify verbal and written fluency as key objectives

in school, it is more difficult for us to see that these two forms—speech and writing—are essentially linear representations. With brainstorming webs, students have self-generated, nonlinear tools for activating fluent thinking, which reflects the holistic networking capacity of the human brain.

Students call upon their disposition for ingenuity, originality, and insightfulness to express this form of thinking. Brainstorming webs provide the tools for venturing to the edge of our thinking—and thinking beyond the edge. Brainstorming also opens other Habits of Mind, such as thinking flexibly and wonderment.

Many teachers have a particular concern about brainstorming: What happens after the storm? Students need to move beyond the generation of ideas. They need to gain organizational control over ideas, and they need self-control to support more systematic and analytical thinking. To address this concern, another type of visual tool supports another cluster of Habits of Mind.

Task-Specific Graphic Organizers

Unlike webs, which facilitate thinking *outside* the box, most graphic organizers are structured so that students think *inside* the box. A teacher may create or take from a teacher's guide a specific visual structure that students follow and fill in as they proceed through a complex series of steps. Teachers often match these organizers with specific patterns of content or the development of content skills; thus, they are called "task-specific organizers." These highly structured graphics may seem constraining at times, yet each can be fruitful for students as they systematically approach a task, organize their ideas, and stay focused (especially when the task is complex).

For example, many organizers are sequential, showing the steps for solving a word problem, organizing content information for a research report, learning a specific process for a certain kind of writing prompt, or highlighting essential skills and patterns for comprehending a story. Because these types of visual tools are highly structured, they directly facilitate several Habits of Mind: persisting, managing impulsivity, striving for accuracy, and thinking and communicating with clarity and precision.

The visual/spatial structure guides students through the steps, box by box or oval by oval. Teachers report that one of the main outcomes of using graphic organizers is that they provide a concrete system and model for proceeding through a problem that students would otherwise abandon because they have not developed their own organizational structures for persisting. An obvious reason for this advantage is that the visual structure reveals a whole view of the process and—an important feature—an end point.

This kind of structuring also provides visual guidelines, much like a rope students can grasp. They don't impulsively jump outside the problem to what Benjamin Bloom (1956) calls "one-shot thinking." The visual modeling shows students that they can manage their impulsivity and stay in the box when they need to focus on following through to a solution. This kind of modeling also lends itself to greater accuracy and precision of language. Students usually don't have a record of their thinking, along with the steps and missteps they took along the way. They also have a hard time differentiating one idea from the next. By visually capturing their thinking, students can look back on their ideas, refine them, and share them with others to get feedback.

Both brainstorming webs and graphic organizers help students become familiar and fluent with networking and patterning information. Such work leads to a question about the relationships between thinking skills instruction and visual tools: Are there common patterns of thinking keyed to questions we ask every day in schools that could—if represented visually—deepen students' understanding and extension of their own thinking and Habits of Mind?

Thinking-Process Maps

A third kind of visual tool simultaneously supports thinking inside and outside the box. These tools—which I call thinking-process maps—are designed to reflect common patterns of thinking, from fundamental cognitive skills such as comparison, classification, and cause-effect reasoning to integrated visual languages such as Concept Mapping™ (Novak & Gowin, 1984), systems diagramming, and Thinking Maps.

Although these dynamic tools often *look* much like some static graphic organizers we see in classrooms, the differences in the purpose, introduction, application, and outcomes are significant. Thinking-process maps scaffold many Habits of Mind related to brainstorming webs and organizers, but these tools focus explicitly on different forms of concept development. They facilitate more explicitly four Habits of Mind: questioning and posing problems, gathering data through all senses, thinking about thinking (metacognition), and listening with understanding and empathy. When students are transforming information into knowledge using Thinking Maps, they are in dynamic congruence—or a dance—with what is already going on in their networking brain. Pat Wolfe summarizes the connection between brain research and Thinking Maps: "Neuroscientists tell us that the brain organizes information in networks and maps. What better way to teach students to think about ideas and organize and express their ideas than to use the very same method that the brain uses" (Hyerle, 2004, p. xi).

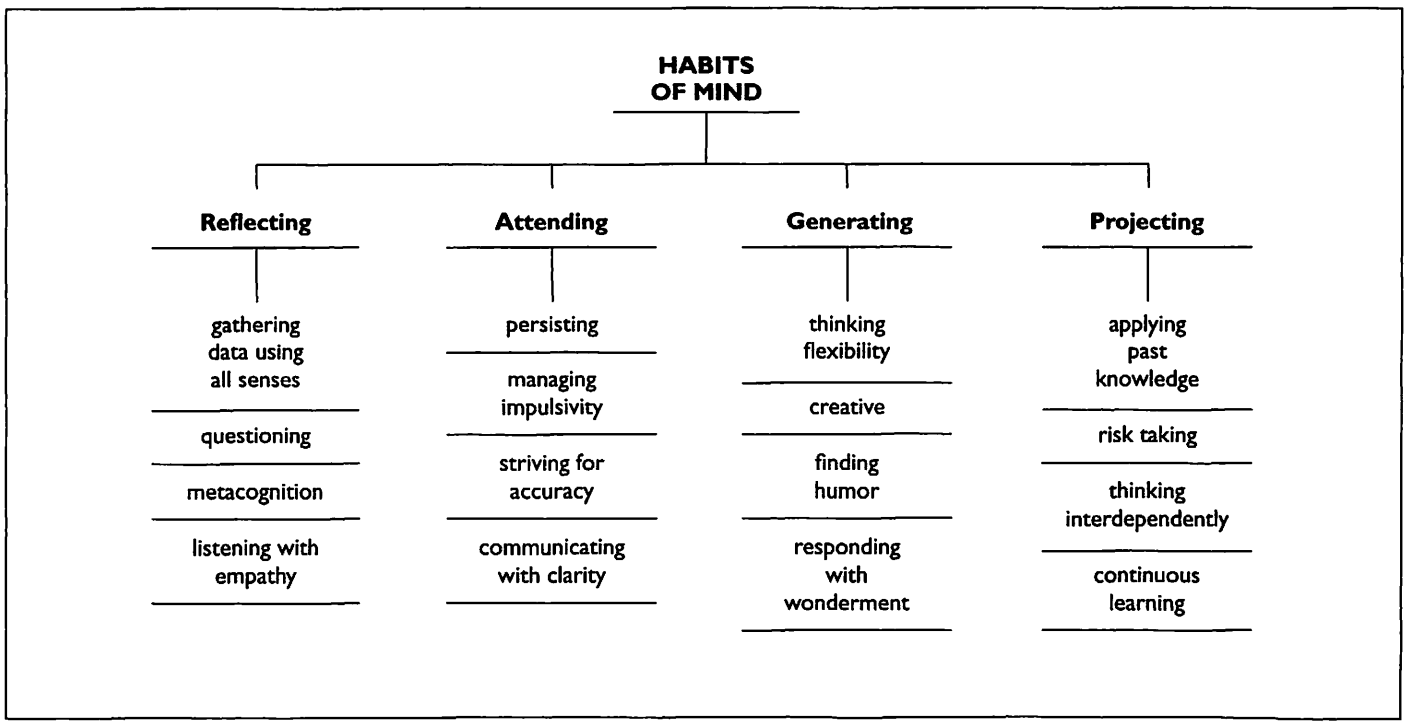
Thinking Maps and the Habits of Mind

Although it may appear obvious that using Thinking Maps, like many other approaches, will at some level support the development of the Habits of Mind, deep interdependencies link the activation of these 8 cognitive patterns as visual representations and the 16 intellectual behaviors. To create an organizing framework for making connections between thinking maps and the Habits of Mind, I have organized the habits into four informal groups: reflecting, attending, generating, and projecting (see Figure 9.4). In the following analysis, I use these categories to interpret how a classroom of 1st grade students improved their Habits of Mind as they independently and interdependently mapped out, comprehended, and wrote paragraphs about a book they had read.

At Mt. Airy Elementary School in Carroll County, Maryland, the principal, Dr. Thomasina DePinto Piercy, guided the simultaneous development and use of the Habits of Mind and Thinking Maps across her whole school. Through Dr. Piercy's interactions with Art Costa and me, all of the teachers in this K–5 school were trained in Thinking Maps,

FIGURE 9.4

A Tree Map of the Habits of Mind



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with the required follow-up coaching over a 12-month period. Teachers worked as a whole faculty and met in grade-level teams, attending workshops and receiving ongoing classroom support for focusing on both approaches. The eight Thinking Maps were posted in every classroom along with the vocabulary of the Habits of Mind to remind teachers and students to consciously apply and integrate the maps and habits in their daily work.

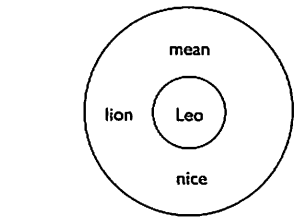
With this background of professional development in mind, imagine you are stepping into a classroom with Dr. Piercy and me some years ago, as we observed and videotaped a classroom of 1st graders who had recently finished reading the book *How Leo Learned to Be King*. (To view this video in edited form as you read, you may also go to www.thinkingfoundation.org.)

As the class began, the students were asked to respond to this question posed by their teacher, Ms. Smith: "How would you organize your thinking about this book?" Most high school students would have trouble with this question! But these young students had become fluent with Thinking Maps over the previous 18 months, so when Ms. Smith asked this question, they responded thoughtfully with ideas about which cognitive tool they would use to organize their thinking, how they would use the maps, and why. After a 30-minute small-group discussion, students were asked to return to their own desks, to choose the Thinking Map they thought would be most useful, and to begin mapping out their ideas. They then began transferring their thinking from the map into a paragraph of writing. As you look at Figure 9.5, you can see the initial ideas they offered, which Ms. Smith wrote on the whiteboard at the front of the class.

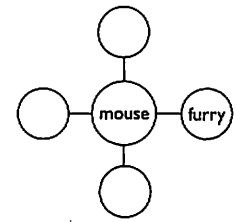
Here is a key: As you view the page of the partially created Thinking Maps and "hear" the language of the students as they generated both the maps and the classroom discourse that follows, consider that when students are suggesting a map to use, they have established a cognitive and metacognitive stance in relationship to the text. They are decoding the underlying cognitive patterns—or text structures—they see distributed across the linear progression of the story. You can hear *and* see the language of cognitive skills surfaced: *describing*, *comparing*, determining *cause*. Here is how the 1st graders organized their thinking about this book:

FIGURE 9.5

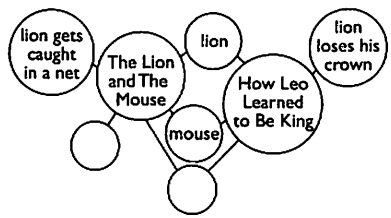
Students' Thinking Maps



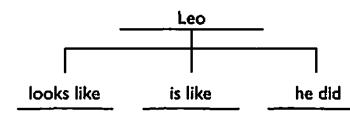
Leo Circle Map



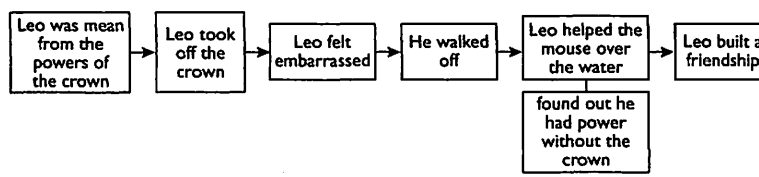
Mouse Bubble Map



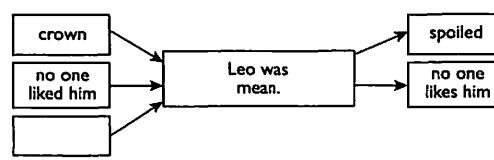
Comparing Two Books Using the Double Bubble Map



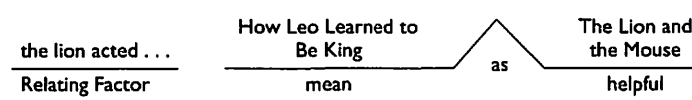
Leo Character Analysis Tree Map



Leo Character Development Flow Map



Cause of Leo's Being Mean Multiflow Map



Bridging Qualities of Characters Across Text

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Erin: You could use the circle map . . . put the topic in the middle and all ideas that you get in your mind from that topic, you write down in the circle . . . Leo . . . details about Leo . . . he was mean and he was nice.

Megan: A bubble map about a mouse. You say a word about what the mouse is, like furry . . . describing words.

Billy: We could do a double bubble. We could compare *How Leo Learned to Be King* and *The Lion and the Mouse* . . . they both have a lion and a mouse.

Mark: A tree map. I am thinking of . . . about Leo . . . what he looks like . . . and, um, I think, and what he is like . . . and what he did.

Thomas: You could organize it with a bridge map. In *The Lion and the Mouse,* the lion was mean to the mouse, but in *How Leo Learned to Be King,* the lion was nice to the mouse by helping him get over the river.

Alexis: You could use a flow map. First he was mean. Then when they took off the crown he, like, got a little embarrassed. He walked away, he got surprised, because he met a mouse. And at the end he helped the mouse and *they became friendship.*

Regan: Multiflow . . . what caused him to be mean. The crown made . . . the crown could have caused him to be mean.

Erin: No one liked him. They took away . . . they didn't want him to be their king.

Shawn: We've got a lot of maps, don't we?

Teacher: That makes me think . . .

Shawn: . . . that we are like 2nd graders! [Laughter by all]

From the point of view of research on reading comprehension, here is an excerpt of our analysis of what we saw during this classroom observation:

> [A] closer look shows that students have changed how they are understanding texts: They are surfacing dynamic patterns of content from the linear landscape, the wall of text. The range of

> structures bound within the line-by-line text becomes unveiled in the form of mental maps. They are changing the form, transforming text maps. (Piercy & Hyerle, 2004, p. 65)

Given this example of 1st graders' fluency with Thinking Maps, let's step back and consider how the Habits of Mind are intimately connected to fundamental cognitive skills and facilitated through the use of Thinking Maps.

Reflecting

Gathering data through all senses arises from a fundamental interplay between the "senses" of the body and of the mind trying to "make sense" of the data. As a Habit of Mind, openness to all sensory experiences is heightened by our capacities to organize and reflect on the range of senses. When students are offered a cognitive map and *specific language* as conscious filters for their primary sources of information (their senses), then their capacity for valuing information is enhanced and their descriptive language grows. In this classroom, when Megan says she could use a bubble map for describing the mouse as "furry," she is beginning to cluster together and reflect on the unique qualities she perceives as important. She is aware that the bubble map is defined by the cognitive process of *describing* qualities of things based on all the senses and that she and her classmates will attempt to use adjectives to describe the qualities. This tool helps learners *gather* perceptions in a map and then expand their attention by seeking a range of different types of descriptors using all of their senses. Within the Thinking Maps model, the definition of the cognitive skill of "describing" is clarified for students: descriptors are sensory, logical, or emotional (aesthetic). For example, describing the mouse as "white" would be a sensory description, "fat" would be a logical description (based more on measurement of what one considers "fatness"), and "beautiful" is an aesthetic or emotive description (based on the eye of the beholder).

Students learn to draw upon this fundamental definition embedded in the bubble map to describe sensory information across disciplines, such as *properties* in science, *attributes* in math, *character traits* in the study of

literature, *societal/cultural traits* in the social sciences. Having a visual tool in hand to gather the sensory information supports students in *reflecting* on how they are seeing the interrelationships of different kinds of information from their senses—the sounds, tastes, smells, and textures as well as the visual information. Learners become aware that often this information is not "factual" just because they sense it, but that their sensory perceptions are framed by the context of the investigation and their own prior knowledge.

When Megan suggested using the bubble map, she, like all the other students, was asking a question of herself and her peers: How could we each describe this mouse? Each of the eight Thinking Maps, respectively, is thus a reflective question connected to a thinking skill and opens wide the doors to the maps of a child's mind. By giving students these tools, the essential questions that teachers ask students on a day-to-day basis in classrooms become *student* centered, based on well-defined cognitive skills as patterns:

Map and Thinking Skill	Essential Question
1. Circle map for defining	How am I defining this idea in context?
2. Bubble map for describing	How am I describing this thing?
3. Double bubble map for comparing	How are these alike and different?
4. Tree map for categorizing	How do I group these things together?
5. Brace map for part/whole	How do the physical parts fit together to form a whole object?
6. Flow map for sequencing	How do I see this sequence of events?
7. Multiflow map for cause-effect reasoning	How did these causes lead to this event and what were the effects?
8. Bridge map for analogies	How do these ideas transfer to other ideas?

Early in the process of learning Thinking Maps, teachers and students become aware that these essential questions and combinations of questions are foundations for learning content-specific knowledge and

building academic vocabulary. Students become aware that the questions that they ask of themselves, or that are asked of them at the end of chapters in textbooks and on tests, often require multiple steps of thinking. The language of Thinking Maps then becomes a framework for decoding the cognitive processes embedded in text or in a given task, giving students an independent way of organizing, interpreting, reflecting upon, and generating their own problem-posing questions about learning.

As students move from novice to expert use of Thinking Maps, a metacognitive stance develops from gathering data from their senses and questioning how they are perceiving and mapping the information. The Thinking Maps thus offer a space for "displayed *metacognition*" as each fundamental cognitive skill is surfaced visually by the learners in order to see their own representation of a pattern of information. As students *see* how they are thinking in maps, what is immediately apparent is the spatial edge of their knowledge base (comparable to what we do when we look at a road map that shows only a part of a city). They also see the open mental spaces within the configuration of the maps and may think about their thinking: What is it that I don't know?

As shown in the example of 1st graders thinking about Leo the lion, students already have basic definitions for cognition, from which they can develop deeper metacognitive responses. In most classrooms, from kindergarten to college, few students could actually name and define their fundamental human cognitive skills, and far fewer would know how to activate these skills and transfer them across disciplines. A question that is apparent from the discussion in the first part of this chapter is this: When *cognitive* skills are not clearly identified and developed over multiple years, how can we expect students to become *meta*cognitive?

Memory plays a central role in cognition *and* reflection. Because the brain can hold only limited information in short-term memory, Thinking Maps offer an external place to hold information while simultaneously enabling learners to internally reflect on the holistic patterns of their thinking in real time. They don't have to "think back" and remember in their mind, but only look down at a representation of the thinking they created from a blank page. As 1st grade students, Billy has the ability to re-*view* and "re-*vision*" his double bubble map comparison of two books

(text-to-text analysis), while Regan can view her thinking of the multiple causes and effects for Leo becoming a "mean" leader. They both can then go back to reference the text for more information and clarification. Both children can also view how much information they have mapped, expand and reconfigure the maps, reflect on the validity of their claims, and spatially *see* what they don't know.

Within the Thinking Maps language, the capacity to reflect on our thinking using our senses, questioning, and metacognitive behaviors is at one level supported through the eight interrelated tools. There is an additional metalevel to the language that comes out of the field of frame semantics (Lakoff & Johnson, 1980) and is defined by the common phrase from the field of critical thinking: *frame of reference*. Although not shown in the 1st grade example, a central dimension of the Thinking Maps language is the use of a rectangular frame that is hand drawn by students around any one of the maps. The metacognitive frame is used by stepping back from the map or maps being created and asking these reflective questions: What is influencing how you are thinking? What experiences and beliefs are influencing how you are seeing this information? Where are your sources? How are you approaching this problem? If this is what you know, what is unknown to you? The metacognitive frame is an essential tool for use in the areas of interpretation of texts, current events, cultural awareness, conflict resolution, and for any topic that surfaces multiple perspectives.

For example, when Regan was analyzing the causes and effects for Leo being "mean," the teacher could have added a rectangular frame around the multiflow map and asked Regan and the other children, "When in your life have you felt like you were acting mean? What caused you to be mean?" The students could then have used this frame of reference to connect themselves to the literary character for deeper, personal, more meaningful interpretation of the text.

Ultimately, Thinking Maps provide a language for collaborative cognition and deeper listening to oneself and others. The cliché "I see what you mean" gets expanded to include *how* others are seeing *what* they mean. The visual representation on the page or whiteboard becomes the mental work space between students and teachers so that one may listen and then see the holism of another person's thinking.

The capacity to listen to, to visualize, and to reflect on one's own thinking—metacognition—is deeply related to the lifelong behavior of being able to listen with empathy to others. Listening to oneself may be even more difficult for some than listening closely to the ideas of others. The maps, along with the metacognitive frame, engage deeper discourse and listening in learners of all ages, for often is it very difficult to follow the auditory sequence of ideas and much easier to "see" the holism of meanings as they are drawn out from a blank page. Seeing the evolving Thinking Maps developed by others through a common language engages a quality of reflectiveness, as one begins to see the collaborative overlapping patterns of thinking beyond the mind's eye.

Attending

A second cluster of Habits of Mind that seem closely related are in the area of "attending" over time to tasks that require patience and often analytic, detailed thinking. If students do not develop the internal capacity to stay with a problem, an assignment, or a project that may extend over minutes, hours, days, and weeks, they will be seduced by the instant gratification offered by a visual media–saturated world that often honors the immediacy of quick sound bites and visual bits over close attention to quality thinking.

As students like the 1st graders in the example develop a novice-level use of Thinking Maps, they each have eight distinct pathways for getting started in *posing questions* and *persisting* toward a solution to a problem. The students could initially decide on a single pattern for thinking about the story and then map out alternative options for pursuing the interpretation of the text. As mentioned earlier, what is not revealed in the snippets of classroom interaction is that, after her students had created the maps, Ms. Smith then asked them to return to their desks and independently choose one or several of the maps to use. They individually mapped out their thinking and then began to write a paragraph about the story. The maps then became the movable mental workspace for shifting from classroom discussion, to prewriting, to a final product.

The complete 60-minute videotape of classroom work shows many students raising their stretched hands to get the attention of the teacher,

jumping with answers to offer, but not with what Benjamin Bloom called "one shot," impulsive thinking. They knew they were responding not with one answer that was either right or wrong, but with an expectation that they would offer their ideas within a broader map and pattern of thoughts. In this way, Thinking Maps have a built-in "wait time" (Rowe, 1974) that establishes in classrooms a way of managing the impulsivity not only of the students but of teachers as well. It is evident on the videotape that Ms. Smith seemed ready to move on at times, but the maps offered an efficient and effective process for moving to final reflections without prematurely moving to the writing process. With alternative maps always available, with strategic use of multiple maps, and with the reflection time built into the process of constructing the maps by hand on paper, whiteboard, or computer, classroom participants are able to see beyond the blurted answer and have a visual record they can use for reflecting on their systematic processes.

Developing the habits of *persisting* and *managing impulsivity* created an environment in which a deeper level of analytical thinking was required of students in this classroom. The student examples shown are only the starting point for accurately pulling more information from the text, organizing the ideas in meaningful patterns, and then being able to *communicate the ideas with clarity and precision.* Each Thinking Map begins with a graphic primitive, such as the flow map that Alexis offered for sequencing the plot of the story. She detailed the sequence of the story by starting with one box and an arrow and extending to six boxes: from Leo becoming mean after becoming king to ultimately "becoming friendship" with the mouse. Alexis is showing a capacity to accurately display the events of the story, which is easily checked against the text by Alexis herself, her peers, and the teacher.

By the time students had returned to their desks and mapped out their thinking for a piece of writing, they had expanded and clarified their thinking. When we take into account short-term memory capacity, having a visual record along with a verbal explanation gives students and teachers a way of adding more information in a structured way. The visual form allows for clarity of expression because students can clearly see the reasoning that they are doing and present this to classmates and their teacher as a clear view of how they have put information together.

The example used to this point has been with literature at a 1st grade level. This can be compared with a 40-page Thinking Maps document created by a high school student from the Chicago area. All the teachers and students at Niles North High School had been trained in Thinking Maps and Thinking Maps software, so this student used the Thinking Maps software for mapping out a whole biology text, chapter to chapter. For each chapter she decided which map or maps best reflected the key concepts and information of the text. With accuracy and great clarity, for example, she showed types of cells using a tree map, a detailed causal feedback system in the blood cycle using a flow map, and dozens of intricately interrelated parts of a muscle using a brace map. What the 1st grade students were doing with Leo the lion for the interpretation of literature was mirrored by this student at an advanced, precollege level of sophistication. In both examples, the precision of language and the clarity of the thinking are apparent, demonstrating that the maps enable students at any level to attend to long-term tasks requiring *persistence*, *managed impulsivity*, and most of all, *accuracy*.

Generating

One of the common theoretical and practical dimensions of the Habits of Mind and the Thinking Maps models is that both rely on the *interdependency* of, respectively, 16 dispositions and 8 cognitive skills. This is evident when we see how the analytical behaviors of *persisting*, *managing impulsivity*, *striving for accuracy*, and *thinking and communicating with precision and clarity* need to be in balanced development with more generative dispositions such as *flexibility*, *creativity*, and *finding humor and wonderment* in the approach to problems. Both models directly honor and support the interdependence of analytical and creative thinking, rather than seeing them as dichotomous.

The Habits of Mind concerned with analytic accuracy and precision are intimately connected to learners' abilities to be flexible and creatively generate ideas. Costa and Kallick (2004) state that "flexible people are the ones with the most control" (p. 22), because they are able to shift their thinking and retain key information without losing their focus. Looking back at the 1st grade maps, ask yourself: "Is this creative or analytical

thinking?" It is both, I suggest, because students are expanding rich patterns of ideas in multiple, linear, and nonlinear ways across the page. There is an inherent structure in the language of Thinking Maps that is generative, enabling students to always start with a blank sheet of paper and draw out their thinking. Students do not need preformed templates, as is the case with so many graphic organizers. One of the barriers to thinking found in most graphic organizers is that students may be given templates and be required to stay inside the boxes, thus limiting their capacities to be flexible and creative.

Several of the Thinking Maps, such as the circle map, are often perceived as directly supporting creative, imaginative thinking. First-grader Erin understands the map and its purpose when she says that she could use a circle map for Leo by putting "the topic in the middle and all ideas that you get in your mind from that topic, you write in the circle." Often we ask students to draw the "frame" around the circle map so that they begin the metacognitive process of linking the creation of ideas to their own experiences and prior knowledge. This challenges students to think about what in their frame of reference may be constraining a more flexible, creative approach to a topic or a problem, which often causes a deeper, expansive ripple effect of flexible thinking. By placing the concentric circles in a frame, students are actually mirroring an ancient visual tool of the East, called a *mandala*, used for reflecting on one's daily life surrounded by deities symbolically representing different ways of being in the world. Carl Jung used this mandala form regularly as he creatively reflected on his own shifts of mind and heart each morning. He also used mandalas with his patients to help them open their mind while centering their thinking and feelings.

In a more subtle way, Thinking Maps also support open, flexible thinking as a pathway to humor and wonderment. I once opened a fortune cookie after a Chinese meal to read this saying: "Life is a tragedy for those who feel, a comedy for those who think." Although we want empathic learners, we also want creative problem solvers living at the edge of their knowledge and finding the discrepancies when they reflect on the state of the world with its ambiguities, contradictions, and absurdities. At the end of the 1st grade classroom conversation, everyone shared in the

laughter when Shawn verbally cut off his teacher. Shawn said, "We've got a lot of maps, don't we?" and the teacher began to respond by saying, "That makes me think—"; then Shawn cut her off, saying, "That we are like 2nd graders!" We all laughed, I believe, because Shawn could see that he and his classmates had gone beyond themselves: he could *see* the class as highly productive thinkers, and he responded with awe and with an obvious enjoyment of learning.

Great comedians usually have a personal, social, or political critique or a unique perspective on the world that shows the incongruity of self-evident truths drawn from the foibles of being human. The teachers I remember are those who could surface absurdities, generate meaningful humor out of the context of classroom content teaching, and engage students in a playful discourse filled with dry humor. Sometimes we can unveil a certain idea that opens a student's mind to perceiving the world in a different way. Once, with a high school class in California, I engaged the students in seeking out the central metaphors in their own writing through the use of a multilevel bridge map that I called a "World Map" for generating metaphorical understandings in common language (Hyerle, 1996). This led one student to walk up to me afterward and state in an awestruck manner, "I never understood that language works like this." The awe and wonderment was about this student understanding the analogical bridge between thought and language that can be mapped out and seen.

Projecting

Shawn was projecting himself beyond the moment, seeing himself not just as a 1st grader, but as a 2nd grader and a continuous learner. This ability to project beyond the moment may be the catalyst for animating the Habits of Mind. If a student does not hold a vision of being a continuous learner, then even the idea of developing the Habits of Mind may seem irrelevant. The students in this classroom showed that they could project themselves as confident learners by applying past knowledge to this new text, taking risks with their thinking as they mapped it out, and working interdependently as a group to discover different ways of working with the text.

We can only learn in the moment from the accumulated past information and knowledge that reside within the schemas and frames we hold

in our memory. The Piagetian concepts of accommodation and assimilation rely on an understanding that we each have life experiences saved as rich, deep schemata in the recesses of the brain that are animated and transformed by the mind. Students' abilities to apply past knowledge are dependent upon them holding onto the ideas in long-term memory in a way that can be called up to consciousness in order to be applied to present learning. Because students are often asked to conceptualize and remember ideas in a linear form (auditory, written, and numeric), their knowledge may not be deeply connected, and thus neural networks are holding onto information through mindless rote and repetition. Students end up playing the game of school: they memorize information for the Friday test, and it is then lost.

Thinking Maps help to transform information into knowledge that then supports students in applying new information and knowledge in novel situations. The double bubble map and the bridge map were both used by these students to, respectively, compare a book they had read in the past to the present book, and to create an analogical bridge between how different characters acted in the two books. Looking closer at this situation we can see that the 1st grade students have a rudimentary use of Thinking Maps; but with each year of using these tools, they will begin to fluidly and dynamically transfer these cognitive skills and maps into novel situations, remembering different ways of applying isolated maps and also remembering how they used different combinations of the maps to understand a text.

The foundation of knowledge and the fundamental language for learning that students gain through Thinking Maps also offer a platform for risk taking. Because they know that they have eight pathways for patterning their ideas, students gain support in moving beyond their existing experiences and knowledge to discover new territories of content knowledge and thinking. One of the greatest barriers to risk taking is the expectation for "right" answers, inside and outside classrooms. So many students, and teachers, are driven to find the one right answer; yet even if there is one "right" answer in a given task, it is still found within a pattern of information. Openness to thinking as risk taking does not mean that students play out on the edge of their ideas without an understanding of

taking responsible risks. The Thinking Maps models offer both dynamism and structure, enabling students to risk playing out their ideas about, for example, *How Leo Learned to Be King*, while also acknowledging that there are useful structures through which they can take risks.

This dynamism and this visual structure of the language make these tools public in form, thus facilitating group interdependence. Once individual students learn to use the maps, cooperative learning is elevated to a new level because groups now have a way to see thinking, communicate evolving thoughts, and synthesize ideas into new maps that facilitate the integration of ideas into conceptual understandings. It is quite evident in this example that these 1st grade students have a common language that they use with confidence and fluency and for clarity of communication. So often in collaborative groups there is a dominant voice or a strongly stated belief that can hold sway over other people. We have found that Thinking Maps give all learners silent visual pathways for showing classmates and teachers their thinking even if they cannot or do not share their ideas verbally.

In this example, students moved from a classroom discussion to individual work with the text. Often teachers will use the technique of think, pair, share (McTighe & Lyman, 2001) with Thinking Maps: individual students show their thinking by using one or multiple maps, pair up with a peer to talk through their ideas, and then share their maps within the structure of a cooperative group. In the cooperative group, they can effectively and often efficiently rethink, reorganize, and synthesize the individual Thinking Maps into a rich complex of new ideas. The maps created in the cooperative group may then be shared with the whole class by posting them on the wall for a gallery walk, sending them around the room in carousel fashion, or presenting them via a media presentation (using Thinking Maps software or simply on an overhead projector).

The students have a common language for thinking and communicating, but so do the teachers as members of a faculty and of larger learning communities. The use of Thinking Maps as a language for lifelong learning is instilled when all are involved. The interdependent nature of the tools enables participants from across learning communities—classrooms, grade levels, whole schools, feeder patterns, and whole districts—to think

interdependently and to use a common language for learning and leadership. Over the past five years, our work with Thinking Maps has shifted from the primary focus on improving instruction and learning, to leadership and learning applications across whole schools. The maps are now used to support grade-level teams in curriculum planning and alignment, school leadership teams in decision making, whole-school faculties in effective and efficient meeting facilitation, and for mentoring and coaching (Alper & Hyerle, 2006). The use of Thinking Maps by students, teachers, and administrators across classrooms and whole schools clearly represents to students that this language for thinking is for lifelong learning.

Endnote

Near the end of a two-day leadership seminar through which leadership teams from different schools and school districts learned how to use Thinking Maps for problem posing, problem solving, and decision making, a superintendent and her team presented their work using several Thinking Maps to study the problem of the high school dropout rate in their region. The team showed how they used a circle map for defining the problem in context, and the frame for creatively generating ideas and for reflecting on the stakeholders who were influencing their thinking. This thinking drew them toward the use of a multiflow map for identifying the interdependent short- and long-term causes and effects of high school students dropping out of the learning process. They then transformed information from the two maps into a tree map for analytically organizing the ideas and inductively developing possible solutions. They used several other maps, but ended up using a flow map for detailing a multifaceted plan for dropout prevention.

Of course, this collaborative group was quite happy about the thinking they had developed together and how, during their presentation, the rest of the participants could see their ideas through a common visual language. After the presentations by the entire team, the facilitators of the seminar showed the videotape of the 1st grade students, showing how they used Thinking Maps to think about and interpret *How Leo Learned to Be King*. It was in that moment that these lifelong educators deeply understood how a simple language for generating eight cognitive patterns could

be used to develop ideas and also to join closely together as a group of thinkers. Both groups—an adult team of educators and a classroom of 1st graders—were questioning and reflective, persistent and accurate, flexible and creative, and working interdependently as leaders and learners within an unbroken flow of continuous learning.

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