In an elementary school, the classroom buzzes with activity. Children work in small research and discussion groups, intent on discovering the answer to a question posed by the teacher: “How do simple machines increase work efficiency?” Students collaborate as they hypothesize and design and carry out experiments using levers, pulleys, and ramps. The teacher asks the students to use the concepts of force and energy to describe the results of their experiments. Students express ideas, question each other, and extend their thinking. New understandings emerge and are recorded in sentences next to drawings of their simple machines. A visual scan of the classroom confirms an active learning environment. Student work lines the walls, and books, art prints, science materials, mathematics manipulatives, and computers are evident in the plentiful workspace.

In a secondary school, students use desktop computers and access databases to find relevant material on global pollution. They process the information through the conceptual lens of environmental sustainability as they think beyond the facts. They compare notes with students around the world, and design PowerPoint programs to display their research and deepening understanding of global pollution and sustainability. They scan in pictures to enhance the graphic appeal. These are the students of the computer age, and they produce a score of intellectual, artistic, and informative products.

Down the hall in another classroom, students sit placidly in rows and stare at their textbooks while child after child reads a paragraph. Behind the vacant eyes, minds are playing—outside. The teacher controls the scene from a stool in the front of the room and questions the facts just read. Posters hang on the wall like soldiers at attention, and books sit in tidy positions on the shelves, sorted by size. The room is quiet except for the bored drone of the student reading and the interminable tick of a clock on the teacher’s desk.
The art and science of teaching go beyond the presentation of information. Artful teachers engage students emotionally, creatively, and intellectually to instill deep and passionate curiosity in learning. They know how to effectively use the structures offered by the science of teaching to facilitate the personal construction of knowledge. But the personal construction of knowledge is not “whatever.” The teachers are clear on what they want their students to know factually, understand conceptually, and be able to do in skills and processes.

What may appear to the casual observer as ill-structured activity in a classroom is actually goal-oriented learning. The teacher has artfully designed the lesson with questions and experiences so that students are building and sharing disciplinary knowledge and understanding aligned to academic standards. The learning is purposeful. But the teacher also designs for learning to encourage the discovery of unintended insights and understandings. The discussion of essential questions, inquiry-based learning, and the encouragement to make meaning and express ideas through art supports this extension. Intellectual development, mindful learning, and creative expression are key instructional goals.

Mr. Howe is a middle school social studies teacher. He has been teaching about early American colonization and wants his students to internalize an enduring understanding of history—that developing nations may resist or revolt against a ruling country’s social, economic, and political policies if they are perceived as unjust. He developed the following lesson to help students internalize facts supporting this understanding.

You are a creative designer for Gameboards USA. You have been charged by the president of the company with designing a game to teach fifth graders about the reasons leading up to the American Revolution. Your game must have questions that address the social, political, and economic conflicts between England and the settled colonies.

To assess the students’ factual knowledge on reasons for the American Revolution, Mr. Howe gave a selected response test. As an extension assignment, Mr. Howe asked students to research the causes of two other political revolutions in history (students chose their revolutions from a teacher-supplied list). Then he assessed their conceptual understanding that people may revolt against governmental policies that are perceived as oppressive or unjust through the following task:

You have studied the causes of the American Revolution and two other political revolutions in history. Working in a cooperative group, create a graphic organizer that compares the causes of the three revolutions. As a group, determine one common factor that led to revolution across the three examples. Individually, choose one of the following formats and illustrate that common factor:

♦ Political cartoon
♦ Newspaper article
♦ Poster
♦ Poem
Thinking classrooms employ concept-based curriculum and instruction design models. These models are inherently more sophisticated than traditional models because they are as concerned with intellectual development as they are with gaining knowledge.

Concept-based curricular and instructional designs are \textit{three-dimensional}—that is, curriculum and instruction is focused on what students will . . .

- Know (factually),
- Understand (conceptually), and
- be able to Do (skillfully).

Traditionally, curriculum and instruction has been more \textit{two-dimensional} in design (know and able to do)—resting on a misguided assumption that knowing facts is evidence of deeper, conceptual understanding.

The following performance indicators, for example, are typical expectations across state history standards:

- Identify economic differences among different regions of the United States.
- Compare changes in technology (past to present).

These performance indicators are written in the traditional format of content “objectives,” with a verb followed by the topic. It is assumed that the ability to carry out these objectives is evidence of understanding; but, as written, they fail to take students to the third dimension of \textit{conceptual understanding} where the deeper lessons of history reside. Students will research and memorize facts about the economic differences in regions of the United States, but the thinking stops there. Try this task to reach the third dimension. Complete the sentences by extrapolating transferable understandings (timeless ideas supported by the factual content):

- Identify economic differences among different regions of the United States \textit{in order to understand} that . . .
- Compare changes in technology (past to present) \textit{in order to understand} that . . .

What do you think the writers of these performance indicators for middle school expected students to understand at a level beyond the facts? Below are some possible endings:

- Identify economic differences among different regions of the United States \textit{in order to understand} that the geography and natural resources of a region shape the economy.
- Compare changes in technology \textit{in order to understand} that advancing technologies change the social and economic patterns of a society.

SOURCE: David Ford Cartoons, davidford@cablespeed.com. Used with permission.
We cannot just assume that teachers reach the conceptual level of understanding with students. In fact, years of work facilitating the writing of these essential, enduring understandings with teachers has shown me that it is a skill that takes practice. Extrapolating deeper understandings from factual knowledge is not easy work. It involves thinking beyond the facts to the “So what?”—the significant and transferable understandings. It involves mentally manipulating language and syntax so that conceptual understandings are expressed with clarity, brevity, and power. Teachers across the board say, “This is hard work!” when they begin this writing process. The learning curve is steep, but with a little practice, teachers take pride in their finely honed understandings.

Becoming a three-dimensional, concept-based teacher is a journey that merges best practices in teaching and learning with a developing understanding of brain-based pedagogy. But we have much to learn. So let’s get on with the journey.

THE BRAIN AT WORK

The cognitive sciences have produced prolific writers on the anatomy and functioning of the brain (Calvin, 1996; Calvin & Ojemann, 1994; Mandler, 2004) and on the implications for teaching and learning (Gardner, 1999; Novak & Gowin, 1999; Ritchart, 2002; Sousa, 2001; Sternberg, 2002; Sylvester, 2003; Wolfe, 2001).

At the cellular level, the brain is composed of billions of neurons and trillions of glial support cells. Robert Sylwester (2003) describes the brain’s macrocomposition as a subcortical area consisting of the brain stem and surrounding systems with “pea- to walnut-shaped modular structures” that control basic brain processes governing survival and emotional needs. Above the subcortical area is the cortex. Sylwester (2003, p. 20) describes the cortex as a “six layer sheet of deeply folded neural tissue...that encompasses 85% of our brain, and processes learned rational logical behaviors.”

The sensory lobes process relevant incoming sensory information and integrate it into a unified perceptual field. This analysis is then relayed to the frontal lobes for evaluation and action. Pat Wolfe, in Brain Matters (2001, p. 42), states, “Our human cortex allows us to build cathedrals, compose symphonies, dream and plan for a better future, love, hate, and experience emotional pain, because it is in the cortex that consciousness—our ability to be aware of what we are thinking, feeling, and doing—emerges.”

Other books devoted to the structure and function of the brain provide detailed information related to other parts of the brain, such as the thalamus and hypothalamus, and describe the neural communication process across synaptic divides (Sousa, 2001; Sylvester, 2003, 2005; Wolfe, 2001). But since the focus of this book is developing intelligence through conceptual thinking, a primary function of the cerebral cortex, we will leave the remaining details on the structure and function of the brain to other authors.

It is important to this book, however, to share and affirm an observation by Sylwester (2003, p. 23): “We’re used to thinking of intelligence as something that
occurs entirely within our brain, but this is now seen as a very narrow view of a complex process that also involves our body and the environment in which our body-brain functions.” How true! Intelligence does not operate in a vacuum. Our senses, emotions, physical involvement, and environmental context all play a critical role in the development of intelligence.

SYNERGISTIC THINKING

As a career educator who has climbed peaks and fallen into valleys in my work over the years, I now realize some of the major reasons that children do not retain, transfer, and understand knowledge as well as they should—in spite of the dedicated and tireless efforts of teachers to teach and reteach year after year. Perhaps the most significant reason that children overall are not performing as well as they should academically is that we provide teachers with intellectually shallow curriculum materials that fail to engage higher-order thinking. Let me explain.
To memorize information is lower-level cognitive work. To stimulate more sophisticated, complex thinking, we need to create a synergy between the simpler and more complex processing centers in the brain. This interactive synergy requires the mind to process information on two cognitive levels—the factual and the conceptual. The conceptual mind uses facts as a tool to discern patterns, connections, and deeper, transferable understandings.

But curriculum materials are seldom designed to systematically set up this intellectual synergy between the factual and conceptual levels of thinking. Though concepts are mentioned, and often defined, they appear to be “Oh, by the way . . .” afterthoughts that one might want to consider. To provide teachers with a specific strategy for creating this intellectual synergy, the next section discusses and demonstrates the use of a conceptual lens in curriculum design and instruction.

The Power of a Conceptual Lens

Concept-based teachers know how to adapt lower-level curriculum materials to teach for deeper understanding. For example, they may use a conceptual lens to invite students to bring their own thinking to the study at hand. Janet Kaduce is teaching a unit on the Holocaust in her high school class. She invites students to consider the events in terms of the dual conceptual lens of humanity/inhumanity.

This lens is the vehicle that sets up a synergy between the factual and conceptual processing centers in the brain. Students think deeply because they must process the facts in terms of their relationship to the ideas of humanity and inhumanity.

The teacher uses different types of questions to extend student thinking and deepen understanding:

Factual Questions:

Why was the Holocaust a significant event in world history?
What beliefs did Hitler hold that drove his actions?
Why is Hitler’s persecution of the Jewish people considered inhumane?

Conceptual Questions:

What examples of inhumanity can you cite from our world today?
What acts of humanity can you cite from our present-day world?
How are beliefs, values, and perspectives related to views of humanity and inhumanity?

Provocative (Debate, or Essential) Question:

Can one be inhumane and civilized at the same time? (Explain your answer.)

Students retain the factual information longer because the use of the conceptual lens requires them to intellectually process at a deeper level. Furthermore,
because students are invited to bring their own thinking to the factual study, they are better able to make personal meaning. This invitation involves them emotionally—they are personally invested—and the motivation for learning increases.

Figure 1.2 provides a list of potential conceptual lenses that teachers could use to engage a student’s conceptual mind. The focus a teacher wishes to bring to a study suggests a particular lens, so it is best to start with the topic and then select the lens. There are times, however, such as in literature study, when a teacher might begin with a lens, such as tragedy or archetypes, and then select the support material, but generally the link is stronger if the topic is considered first. Notice that some of the lenses in Figure 1.2 are very broad (macroconcepts), such as system or change; while others are more specific (microconcepts), such as identity or heroes. A more specific lens reflects the teacher’s particular conceptual focus. As a general rule, discipline-based studies (e.g., a literature unit) draw more on the specific lenses; interdisciplinary studies draw on the broader lenses because they can then be accessed by a variety of disciplines involved in the study.

Try this activity to experience the power of the conceptual lens:

1. Think of two specific topics from a curriculum you teach.
2. Choose potential lenses from the list in Figure 1.2 for each topic.

Notice how the lens changes the focus for thinking about the topic.

Which lens do you find most engaging (or challenging) for your topic?

Thinking reflectively (metacognitively), are you aware of how the lens invites you to bring your personal intellect to the study? Does the engagement of your personal intellect increase your motivation and interest in this study?

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<th>Topics</th>
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The Integration of Thinking

When we can rise above the facts and see the patterns and connections between the facts and related concepts, principles, and generalizations—and when we can understand the deeper, transferable significance of knowledge—then we can say our thinking is integrated at a conceptual level. This factual/conceptual integration of thinking should be a conscious design goal for curriculum and instruction.
I view integration as a cognitive process rather than what we do with subjects. Under this view, integration can occur in inter- and intradisciplinary contexts as long as there is a conceptual lens or focus that pulls thinking to the integration level—where patterns and connections are made between the factual and conceptual levels of knowledge.

This integration of thinking allows knowledge to be transferred. For example, the lens of *beliefs and values* can provide intellectual focus to a unit on “The Iraq War” and be the invitation for students to use their own minds to think more deeply. The deeper thinking on the complexities of war leads to lessons of history that can be transferred through time and across situations.

In addition to using a conceptual lens to integrate thinking, teaching inductively to conceptual ideas (generalizations and principles) also facilitates the integration of thinking. These conceptual ideas are commonly referred to as “enduring understandings” (Wiggins & McTighe, 1999), “essential understandings” (Erickson, 1995), or “big ideas” in today’s education jargon.

The enduring understanding that “artists often use a combination of color harmonies to create emotional complexity” is not just an empty idea in art education. It is a synthesis of thought and conceptual understanding supported by concrete
examples—from the bold and vibrant colors of a Matisse still life, which reflect assertiveness and joy, to the muted tones of a Picasso blue period. Chapter 2, “The Structure of Knowledge,” will discuss conceptual understanding in greater depth, stressing the significance for teaching, learning, and intellectual development.

**The Transfer of Knowledge**

The ability to transfer knowledge and skills to new or similar contexts is evidence of deeper understanding and higher-order thinking. Because the coverage model of curriculum design values memorization over the integration of thinking and the transfer of knowledge, these higher-order processes may appear to teachers as serendipitous displays of student genius when they bolt out of the classroom blue. Teachers eagerly e-mail a colleague, “You wouldn’t believe the insight and thinking that came out of Robert and Kim today when we were discussing the global issue of overpopulation!”

Yet integrated thinking and the transfer of knowledge should be daily fare in classrooms. *Making meaning* is not simply doing hands-on activities related to a topic, or learning the meaning of vocabulary words. Making meaning includes the interplay of lower- and higher-order thinking. This means that the design of curriculum and instruction needs to set up this interplay.

![Figure 1.3](image-url)
Richard Paul (Foundation for Critical Thinking) wrote a paper titled “Making Critical Thinking Intuitive” and stated that “intuitive understanding enables [us] to insightfully bridge the gap between an abstract concept and concrete applications” (1995a, p. 2). He calls on all levels of education to teach in a way that fosters intuitive understanding. Paul states,

If we focused attention, as we should, on the ability of students to move back and forth comfortably and insightfully between the abstract and the concrete, they would soon develop and discipline their imaginations... to generate cases that exemplify abstractions. All students have, as a matter of fact, experienced hundreds of situations that exemplify any number of important abstract truths and principles. But they are virtually never asked to dig into their experience to find examples, to imagine cases, which illustrate this or that principle, this or that abstract concept. The result is an undisciplined and underdeveloped imagination combined with vague, indeed muddled, concepts and principles. . . . What is missing is the intuitive synthesis between concept and percept, between idea and experience, between image and reality. (1995, p. 17)

I agree with Paul that there is a lack of intuitive synthesis in teaching and learning. Intuitive synthesis would be an important component in what I refer to as the “integration of thinking.” But I don’t believe the problem starts with teachers. It is a muddled curriculum design that nurtures muddled thinking. Teachers want to do their very best work. They spend many hours of their own time planning and preparing for instruction. But the reality is that we continue to provide low-level curricular materials and weak training in sound pedagogy. Some teachers overcome these realities by redesigning lessons and taking charge of their own staff development. But these teachers are not the norm. We must address the rest.

DEVELOPING THE INTELLECT

Intellectual Character

Schools play a critical role in the development of the intellect. But as Ron Ritchart, in Intellectual Character (2002), so aptly observes,
School . . . [is more about] style than substance, breadth than depth, and speed above all else (p. xxi). We’ve come to mistake curriculums, textbooks, standards, objectives, and tests as ends in themselves rather than as means to an end. (p. 8)

Ritchart cautions that we are teaching for the wrong thing—that we need to keep our focus on the development of “intellectual dispositions” that develop strong “intellectual character” (2002, p. 10). Ritchart defines intellectual character as the “patterns” of behavior, thinking, and interaction that are shaped and exhibited over time (p. 9). He frames the idea of intellectual dispositions under the categories of creative thinking (open-minded, curious), critical thinking (seeking truth and understanding, strategic, skeptical), and reflective thinking (metacognitive) (p. 27).

Many educators feel that the pressure to meet academic standards necessitates coverage and speed, and that there is not enough time to develop “intellectual character.” But let’s not lose sight of the purpose of education. It has to be more than obtaining a fund of information or learning sets of discrete skills. Indeed, the survival of a society depends on its ability to respond intelligently and creatively to social, economic, political, and environmental problems. Information without intellect is meaningless.

We can meet the intent of standards and still keep our focus on intellectual development. The secret is in the design of curriculum and instruction—and in the willingness of the teacher to learn and practice strategies that develop intellectual dispositions. Three-dimensional, concept-based curriculum and instruction provide a powerful frame for the development of these intellectual dispositions.

Creative Thinking

Ritchart states that the dispositions of open-mindedness and curiosity are components of creative thinking (2002, p. 28). Open-mindedness depends on the ability to reflect critically on incoming information, consider and “play” with alternative points of view, and intuitively and flexibly look for patterns and connections between elements. Curiosity drives the development of intelligence. It is the “on” switch for learning, and the gateway to creative problem solving.

The role of emotional engagement in learning has been well documented in recent years (Sousa, 2001; Sylwester, 2003; Wolfe, 2001). We retain knowledge longer and gain deeper understanding when there is an emotional response to learning. This, too, is an important point to remember when designing curriculum and instruction. Creative thinking and learning generate an emotional response because they tap the personal connection to experience.

It is interesting that Anderson and Krathwohl, in A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom’s Taxonomy of Educational Objectives (2001, p. 68), changed the term for Benjamin Bloom’s cognitive process of “synthesis” to “creativity” and moved it to the highest level of intellectual functioning. This change makes sense—because the ability to create requires the production of an original or unique product or idea generated from the synthesis and creative extension of discrete elements.
The area of creative thinking fascinates me because it is the ultimate expression of reflective and critical thinking. Creative thinking becomes increasingly important in a world dealing with complex problems. Daniel H. Pink, a writer, lecturer, and international observer of economic and social trends, wrote an interesting book titled *A Whole New Mind: Moving From the Information Age to the Conceptual Age* (2005). His opening paragraph:

![Figure 1.4](image-url)

*Figure 1.4*

SOURCE: David Ford Cartoons, davidford@cablespeed.com. Used with permission.
The last few decades have belonged to a certain kind of person with a certain kind of mind—computer programmers who could crack code, lawyers who could craft contracts, MBAs who could crunch numbers. But the keys to the kingdom are changing hands. The future belongs to a very different kind of person with a very different kind of mind—creators and empathizers, pattern recognizers, and meaning makers. These people—artists, inventors, designers, storytellers, caregivers, consolers, big picture thinkers—will now reap society’s richest rewards and share its greatest joys. (p. 1)

Hmmm. This is an interesting observation. Pink further states,

The wealth of nations and the well-being of individuals now depend on having artists in the room. In a world enriched by abundance but disrupted by the automation and outsourcing of white-collar work, everyone, regardless of profession, must cultivate an artistic sensibility....Today we must all be designers. (p. 69)

Pink is not implying that we no longer need linear, logical, and deductive thinkers; but he is highlighting the increasing importance of creative thinking to solve increasingly complex problems and to enhance daily lives.

The August 2005 report on “Getting Smarter, Becoming Fairer,” by the Center for American Progress and the Institute for America’s Future, reported that in 2001, 47 percent of U.S. patents went to foreign inventors. Though American citizens received the most patents, they were followed closely by Japanese citizens. Japan, China, and India have each more than tripled their U.S. patent awards since 1991 (2005, p. 10). The innovative and creative edge that the United States has long relied on is facing strong competition today.

Though all disciplines benefit from the use of creative thinking in problem solving, it is a wellspring for the arts. It is alarming to see schools cutting out art programs to make more time for standards drill and kill. Science helps people understand and explain phenomena in the natural and constructed world. Art goes a step further and allows one to create and share a personal interpretation of the physical and sociocultural world.

Creative thinking is the personal construction of meaning. Creative thinking employs imagination and playful tinkering with shapes, sounds, colors, words, and ideas. Creative thinking is the birthplace for unique and innovative products, cultural expressions, and solutions to global problems.

Of all the disciplines, art is the most open-ended. Though it has a formal structure of concepts and principles that provide the language of the craft and critique, art stimulates the creative mind more than any other discipline. The creative mind develops cognitive flexibility; can examine situations, objects, and issues from multiple perspectives; and can propose novel solutions to persistent problems. So even though art has intrinsic value as a personal and social expression of culture and emotion, it has heightened importance today as a powerful vehicle for developing creative thinking. The future of our world depends on the marriage of creative, critical, conceptual, and reflective thinking. No doubt about it.
Critical Thinking

Ritchart (2002, p. 29) includes the dispositions of “seeking truth and understanding, being strategic, and being skeptical” as components of critical thinking. Citizens today are inundated with multiple perspectives and opinions that may or may not be supported by facts. Critical thinkers open-mindedly evaluate incoming information by determining the basis and validity for the views being expressed. They maintain a healthy skepticism toward the information until all the facts are in. They are aware of the times when they are interjecting their personal bias into the evaluation of a situation, and attempt to hold their bias in check as they consider the evidence. Critical thinkers use logic to solve problems. They strategically plan for dealing with the issue by clarifying the problem and its components, by considering the viability of alternative solutions, and by laying out a time line and set of steps to achieve resolution.
Richard Paul and Linda Elder, the director of research and the president, respectively, of the Foundation for Critical Thinking, have contributed greatly to our understanding of critical thinking. I highly recommend the set of 15 ‘Thinker’s Guides’ sold through the foundation (www.criticalthinking.org). These guides are based on decades of research (and critical thinking) by Paul and Elder. In one of these booklets, *The Miniature Guide to Critical Thinking Concepts and Tools* (2004b, p. 1), Paul and Elder provide a helpful definition:

Critical thinking is a process by which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them. Critical thinking is, in short, self-directed, self-disciplined, self-monitored, and self-corrective thinking.

**Reflective (Metacognitive) Thinking**

One of the greatest contributions Paul and Elder have made to the area of critical thinking is a set of intellectual standards. The journey of conceptual thinking, as well as the other kinds of critical thinking, requires ongoing metacognitive work. Intellectual standards and questions (Figure 1.6) provided by Paul and Elder in *The Thinker’s Guide to the Nature and Function of Critical and Creative Thinking* aid this metacognitive work (2004a, p. 26).

In *The Logic of Creative and Critical Thinking* (1995b, p. 1), Richard Paul discusses the symbiotic relationship between critical and creative thinking. He suggests that excellent thinking results in creative ends—“designing or engendering, fashioning or originating, creating or producing . . .,” but to achieve these ends there must be continual metacognitive assessment of our thinking—“is it on-track and sufficiently clear, accurate, precise, consistent, relevant, deep, or broad for the end goals? In other words, creativity and criticality [are] interwoven into one seamless fabric” (p. 2).

Metacognitive assessment of thinking needs intellectual standards. Teachers can use the work of Paul and Elder to help students reflect on the quality and progress of their thinking abilities. We have so much work to do in the area of metacognition. These intellectual standards are a solid starting point.

**Conceptual Thinking**

Though Ritchart and Paul do not single out the area of conceptual thinking in their discussions of intellectual work, it is a recognized form of thinking that includes aspects of critical, creative, and metacognitive thinking. Conceptual thinking requires the ability to critically examine factual information; relate to prior knowledge; see patterns and connections; draw out significant understandings at the conceptual level; evaluate the truth of the understandings based on the supporting evidence; transfer the understanding across time or situation; and, often, use the conceptual understanding to creatively solve a problem or create a new product, process, or idea. This book is dedicated to helping educators understand the nature of conceptual thinking, its importance to the overall development of the intellect generally, and how to adapt curriculum and instruction to develop this complex form of thinking.
**Figure 1.6** Intellectual Standards and Focus Questions

| Clarity | Could you elaborate further?  
|         | Could you give me an example?  
|         | Could you illustrate what you mean?  
| Accuracy | How could we check on that?  
|         | How could we find out if that is true?  
|         | How could we verify or test that?  
| Precision | Could you be more specific?  
|         | Could you give me more details?  
|         | Could you be more exact?  
| Relevance | How does that relate to the problem?  
|         | How does that bear on the question?  
|         | How does that help us with the issue?  
| Depth | What factors make this a difficult problem?  
|         | What are some of the complexities of this question?  
|         | What are some of the difficulties we need to deal with?  
| Breadth | Do we need to look at this from another perspective?  
|         | Do we need to consider another point of view?  
|         | Do we need to look at this in other ways?  
| Logic | Does all this make sense together?  
|         | Does your first paragraph fit in with your last?  
|         | Does what you say follow from the evidence?  
| Significance | Is this the most important problem to consider?  
|         | Is this the central idea to focus on?  
|         | Which of these facts are most important?  
| Fairness | Do I have any vested interest in this issue?  
|         | Am I sympathetically representing the viewpoints of others?  

DISCIPLINARY WAYS OF THINKING AND DOING

The chapter to this point has discussed different kinds of thinking in general terms, but each discipline (art, mathematics, etc.) draws on its own unique processes, tools, and approaches to making meaning. My good friend and colleague Lael Williams and I have had many discussions on the importance of disciplinary depth for quality problem solving. My work with concept-based curriculum and instruction has emphasized the importance of systematically building conceptual knowledge, understanding, and processes/skills by discipline through the grades. Lael agrees—“Patterns of behavior, thinking, and interacting derive from the deep and personal experiences with disciplinary ways of knowing and doing over time.” The artist, scientist, mathematician, and social scientist view and approach problems to solve in ways that are consistent with the essence of their discipline.

Lael advocates the design of curriculum and instruction that gives students the experience of being “practitioners” in a discipline. This means going beyond the teaching of content in a subject area. It means that the teacher becomes familiar with the disciplinary ways of knowing, understanding, and doing so they can design learning experiences that develop these unique approaches to problem solving and insight. This does not mean that students should always learn in disciplinary “boxes.” On the contrary, examining problems and issues through interdisciplinary perspectives gives breadth and depth to understanding. But the reality is that interdisciplinary work is only as strong as the content, concepts, and approaches of the various disciplines brought into the study. So our suggestion to curriculum developers and teachers is this—develop disciplinary ways of knowing, understanding, and doing systematically through the grades, but engage students in complex problems to solve, or issues to understand, that encourage the flexible use of disciplinary knowledge and processes in interdisciplinary studies.

THINKING TEACHERS AND STUDENTS

If a major goal is the development of student intellect, then the importance of the teacher’s ability to think critically, reflectively, creatively, and conceptually goes without question. It has been rewarding to observe teachers in concept-based workshops as they think beyond the facts in their subject area and grapple with the “so what” of why they teach particular content. The common refrain at the end of the workshop is, “My head hurts from thinking so hard!” But they also say they can hardly wait to get back to the classroom and apply what they have learned. At first, I wondered why teachers showed so much enthusiasm in workshops after expressing how hard it was to think. And then it struck me—humans are intellectual beings; we are made to think. And when we are successful in using our minds well, we feel intelligent—and are motivated to learn more. This important premise applies to students as well. They feel personal satisfaction from using their minds well.
Sometimes teachers enter the workshops eager to learn, and feel validated for the concept-based pedagogy they already practice. But they gain even deeper understandings and expand their skills as they journey forward. Other teachers may enter the workshop with negative preconceived notions; but when they see that facts are still valued as critical elements in the broader intellectual scheme, they relax and put their minds to work. Some teachers enter with trepidation because they fear they won’t be able to grasp the ideas being presented. But these teachers usually leave with the comment, “I have to think more about concept-based teaching—but I know I can do this!”

Motivating students to think is a major focus for thinking teachers. They understand why society is so concerned that our students learn to think critically, reflectively, creatively, and conceptually. The August 2005 report on renewing our nation’s schools (Center for American Progress/Institute for America’s Future, p. 10) provides alarming statistics cited in the journal Foreign Policy (November–December 2004)—“only 1.6% of 24-year-olds in the United States have a bachelor’s degree in engineering, compared to figures roughly two times higher in Russia, three times higher in China, and four times higher in South Korea and Japan.” Further, the National Intelligence Council, in Mapping the Global Future (2004), states that the number of American engineering graduates has declined 20 percent since 1981, and the percentage of United States undergraduates taking engineering is the second from the lowest of all developed countries. It is apparent that the outsourcing of jobs is moving far beyond the low-skill positions. We truly are in a globally competitive job environment.

**SUMMARY**

This chapter on “The Thinking Classroom” is a reminder that intellectual development has to be a major educational focus if we are to prepare our young people for the complexities of 21st-century living. Thinking classrooms look different and sound different. Teachers in thinking classrooms understand how to use concepts to integrate student thinking at a deeper level of understanding—a level where knowledge can be transferred to other situations and times.

This chapter provides a very brief description of how the brain works and describes the power of a conceptual lens to create a synergy between the factual and conceptual levels of thinking. A chapter that is concerned with the development of thinking also values the idea of intellectual standards, as described by Richard Paul and Linda Elder, to help students metacognitively assess the quality of their thought processes. Ron Ritchart’s ideas on “intellectual dispositions” pull together perspectives on critical, creative, and reflective thinking. And finally, we are reminded that intellectual dispositions gain breadth and depth when they are developed through disciplinary ways of knowing and doing and are given wings in interdisciplinary as well as intradisciplinary contexts.

Chapter 2 extends the understanding of simple and complex thinking by showing how knowledge is structured and by illustrating the difference between the factual and conceptual levels of knowledge, thinking, and understanding.
1. How would you describe your classroom? Try writing a “classroom snapshot.”

2. Would you consider your classroom concept based? Why or why not?

3. How many reasons can you think of to support concept-based curriculum and instruction?

4. How did this chapter relate synergistic thinking to the factual and conceptual levels of the mind?

5. Why does this chapter consider integration a higher-order cognitive function?

6. How does a conceptual lens facilitate the integration of thinking?

7. Why is the conceptual transfer of knowledge a key indicator of deeper understanding?

8. How would you compare education framed by the ideal of intellectual character and dispositions and education framed by a set of academic standards to cover? How can you meet the intent of academic standards without sacrificing the development of intellectual character?

9. How can students’ use of intellectual standards (accuracy, clarity, relevance, depth, etc.) improve their reflective (metacognitive) thinking?