CHAPTER 1

The Thinking Classroom

Classroom Snapshots

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 technology are evident in the plentiful workspace.

In a secondary school, students are skilled at evaluating the credibility of a range of primary and secondary sources 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 using blogs and other social media to display and share their research and deepening understanding of global pollution and sustainability. These students produce a score of intellectual, artistic, and informative products.

Down the hall in another classroom, students sit in pairs. Their assignment is to define the key science terms listed on a vocabulary worksheet. The words are from a chapter in their science textbooks. Together the students first locate a vocabulary word in the text and then think about how the word is used in context and discuss what they believe is the meaning of each word. Once they have come to agreement, each child records the definition on his or her worksheet. The teacher moves among the students providing guidance and feedback as needed.

Did you notice a difference in the three classrooms? The first two lessons take place in Concept-Based classrooms. Students are engaged intellectually. The learning experiences promote inquiry and clearly move students toward conceptual understanding. The third snapshot is of concern. Yes, students are in small groups, on task, and following the teacher's directions, but intellectual engagement is low. Although students will generate definitions, with the teacher's guidance and their resources, there is no evidence that conceptual understanding is advanced.

The art and science of teaching go beyond the presentation and extraction of information. Artful teachers engage students emotionally, creatively, and intellectually to instill deep and passionate curiosity in learning. Teachers know how to use effectively the structures offered by the science of teaching to facilitate the personal construction of knowledge. The personal construction of knowledge cannot be assumed. The teachers are clear on what they want their students to know factually, understand conceptually, and be able to do in relation to skills and processes.

An unknowing observer may not realize that students engaged in different stages of inquiry within a classroom buzzing with activity are actually involved in goal-oriented learning. The teacher artfully designs a lesson with questions and learning experiences so that students are investigating, building, and sharing disciplinary knowledge and understanding aligned to academic standards. The learning is purposeful. But the teacher also designs lessons to encourage the realization of additional insights and understandings generated by the students. In the first two lessons, the student discourse, the teacher's guiding questions, the evidence of inquiry learning, and the opportunities for students to make meaning and express ideas through various media represent a thinking classroom. Within that classroom, intellectual development, mindful learning, and creative expression are key instructional goals of Concept-Based Curriculum and Instruction (CBCI). Here is another example.

Mr. Chen is a high school world history teacher. His students have raised many questions about the 2015–2016 mass migrations of people from Syria and Iraq to European nations. Mr. Chen wants students to internalize two enduring lessons of history: "Warring factions within a nation can lead to mass migrations of people seeking safe and supportive living conditions" and "Receiving nations face complex problems related to aiding or assimilating refugees." He developed the following learning experience to help students internalize facts supporting these understandings and arrive at the lesson of history.

Contest: Can We Solve World Problems?

Our class is participating in a national high school contest. The focus of this year's contest is to uncover the reasons for and the complexities of mass migrations caused by war and conflict. As a class team, we need to respond to the social, political, and

economic issues that caused the mass migrations of people from Syria and Iraq in 2015–2016 and to the consequences for the nations receiving the immigrants.

You are going to divide into two groups to tackle this issue. Group 1, using factual evidence, you need to complete the end of this sentence with a concept in order to create a generalization: "Warring factions within a nation can lead to mass migrations of people seeking. . . ." I expect you are going to generate at least 8–10 concepts from the facts you research.

Group 2, using factual evidence, you need to complete the end of this sentence with a concept: "Nations receiving large numbers of refugees fleeing war need to solve the problem of. . . ." Again, you must cite a concept to end your generalizations, and justify each concept with evidence from facts related to the mass migration of people from Syria and Iraq in 2015–2016.

Finally, each group will report its generalizations and findings to the class, and then collectively we will generate a possible solution to this complex world issue, which we will submit to the contest committee.

Thinking classrooms employ CBCI 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.

CBCI designs are *three-dimensional*—that is, curriculum and instruction are focused on what students, after a lesson, will be able to

- *K*now (factually),
- *U*nderstand (conceptually), and
- *D*o (skillfully).

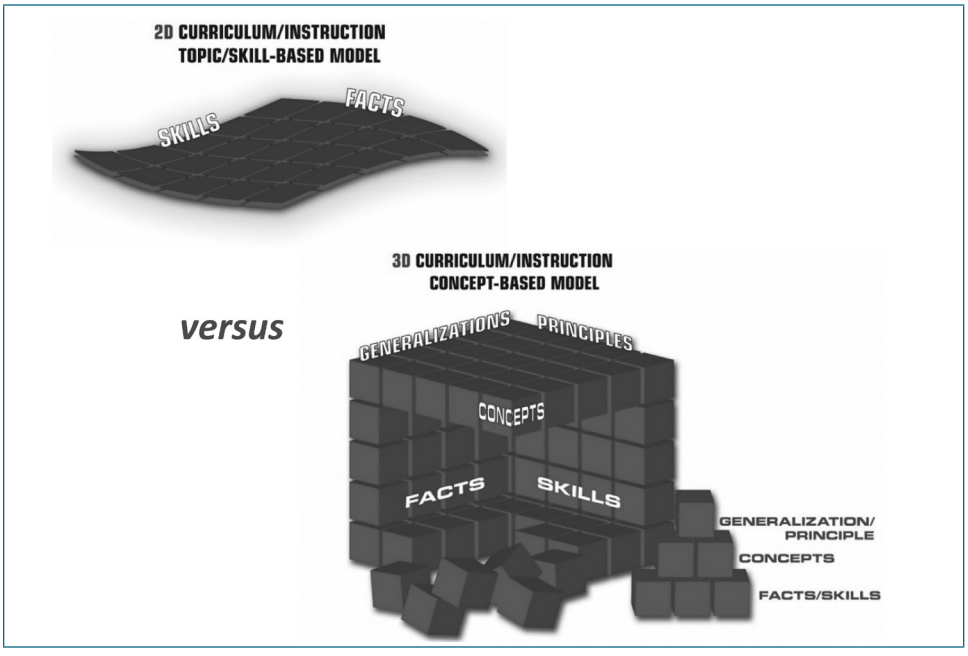
Traditionally, curriculum and instruction have been more *two-dimensional* in design (focusing on students knowing and being able to do)—resting on a misguided assumption that knowing facts is evidence of deeper, conceptual understanding. Figure 1.1 compares the two-dimensional versus the three-dimensional curriculum and instructional models.

Let us consider performance indicators, which are typical expectations across history standards:

- Identify economic differences among different regions of the world.
- 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

FIGURE 1.1: TWO-DIMENSIONAL VERSUS THREE-DIMENSIONAL CURRICULUM AND INSTRUCTIONAL MODELS



SOURCE: H. Lynn Erickson, 2012. Published in Erickson and Lanning, 2014.

carry out these objectives is evidence of understanding, but, as written, they fail to take students to the third dimension of conceptual understanding where the deeper lessons of history reside. Students research and memorize facts about the economic differences in regions, 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 world *in order to understand that. . .*
> - Compare changes in technology (past to present) *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 world *in order to understand that . . .* geography and natural resources help shape the economic potential of a region.
> - Compare changes in technology *in order to understand that . . .* advancing technologies change the social and economic patterns of a society.

We cannot just assume that traditional instruction will help students reach the conceptual level of understanding. In fact, years of work facilitating the writing of these conceptual understandings with teachers has shown us that teaching to the conceptual level is a skill that takes practice. Extrapolating deeper understandings from factual knowledge is not easy work. It involves thinking beyond the facts and skills to the significant and transferable understandings. It involves mentally manipulating language and syntax so that conceptual understandings are expressed with clarity, brevity, and power. When they begin this writing process, teachers across the board say, "This is hard work!" 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 brain weighs about 3 pounds but is far from lightweight when we consider its amazing ability to power the human body. Without our brains, we could not think, move, feel, or communicate! Since the 1990s, the cognitive sciences have produced significant research on the anatomy and functioning of the brain and on the implications of neuroscience for teaching and learning (Eagleman, 2015; Sousa, 2011b, 2015; Sylwester, 2015; Wolfe, 2010).

In a commentary published in *LEARNing Landscapes*, David A. Sousa (2011a) tells us that researchers have now acquired so much information about how the brain learns that a new academic discipline has been born, called "educational neuroscience" or "mind, brain, and education science" (p. 38). This commentary summarizes much of the research detailed in the 4th edition of Sousa's book, *How the Brain Learns* (2011b) and is well worth reading. A particular point he speaks to, that we would like to highlight, is that recent research findings have updated our understanding about the capacity limits of working memory, which have implications for education:

> *Implication:* Recent studies suggest that the capacity of working memory—that is, the number of items it can hold at any one time—is unexplainably decreasing from about seven items to about five. Consequently, teachers should be presenting fewer items in each lesson and asking students to discuss them in more detail so that they are likely to remember them. In other words, less is more. This is no easy task because the amount of information in school curriculums seems to be constantly increasing. Rather, we should be looking to delete items from the curriculum that are no longer relevant for a student to be successful in today's society, and use that time to delve deeper in those topics that are more meaningful. (Sousa, 2011a, p. 40)

This point, along with others in Sousa's writing, reinforces one of the important tenets of Concept-Based Curriculum and Instruction: When curriculum is organized around important, transferable understandings of a discipline, it becomes easier to select relevant facts and skills that exemplify the idea (understanding).

> "Teachers should be presenting fewer items in each lesson and asking students to discuss them in more detail so that they are likely to remember them."
> —David A. Sousa

Unlike many of the gloom and doom educational headlines today, Sousa thinks this is truly an exciting time to be in education, thanks to the new information that educational neuroscience is providing. Several universities in North America and abroad have established dedicated research centers to examine how discoveries in neuroscience can affect educational practice. There is still much to be learned, so we need to be cautious and not let go of common sense, but, as Sousa says, "At the same time, . . . never have we known so much about how students learn and what we can do to make that happen successfully" (p. 42).

As you continue studying Concept-Based Curriculum and Instruction, you will see how current research about the brain is represented and supported by our curriculum design and its implications for instructional pedagogy. The real excitement comes when the joy returns to students' learning, as described in the thinking classrooms at the beginning of this chapter.

Synergistic Thinking

As career educators who have climbed peaks and fallen into valleys in our work over the years, we now realize some of the major reasons that children do not retain, transfer, and understand learning as well as we would expect—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, fall short of expected academic standards is that we provide teachers with intellectually shallow curriculum materials that fail to engage higher-order thinking. Let us further explain this rationale and provide additional support.

Ron Ritchhart (2015) tells us that "the chief goal of instruction, right alongside the development of content understanding, is the advancement of thinking" (p. 33). This powerful idea is unpacked in his new book (and one of our favorites), *Creating Cultures of Thinking: The 8 Forces We Must Master to Truly Transform Our Schools*. Ritchhart separates the terms understanding and knowledge, just as H. Lynn Erickson did many years ago (and as the other coauthors of this book now do!). This distinction is important because it has critical implications for curriculum design and instructional pedagogy. Traditionally, schools and educational research focused almost solely on helping students acquire knowledge—skills and facts. Curriculum

documents and textbooks carefully sequenced worksheets, vocabulary, and long lists of topics and skills students must know. This two-dimensional focus does not work well given the complexities of the twenty-first century—as seen in the complex issue under study in Mr. Chen's class earlier in this chapter.

To develop a knowledge base is important, but, for the most part, it 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 or simple skill level (lower) and the conceptual level (higher). The conceptual mind uses facts and skills as tools to discern patterns, connections, and deeper, transferable understandings. "Understanding requires knowledge, but goes beyond it" (Ritchhart, 2015, p. 47).

"Understanding requires knowledge, but goes beyond it."
—Ron Ritchhart

What is synergistic thinking? Synergistic thinking is the interactive energy that occurs between the lower- and higher-order processing centers of the brain (Erickson, 2008 p. 72). To develop the intellect and increase motivation for learning, curriculum and instruction must deliberately create a "synergy" between the lower (facts/skills) and the higher (conceptual) levels of student thinking. Making meaning requires the interplay of lower- and higher-order thinking. This means that the design of curriculum and instruction needs to set up this interplay.

Curriculum and instructional models that set up a synergistic interplay between the factual and conceptual levels of thinking are critical to intellectual development. The sophistication of the intellectual dance across synaptic divides in the brain determines the quality of the performance. As educators, we are responsible for the design of the dance.

A Concept-Based Curriculum raises the bar for curriculum design, instruction, and assessment. When key concepts and conceptual ideas of a discipline become the "drivers" for learning, we lead students to deeper understandings that transfer across different situations. Foundational skills and critical content knowledge (facts) are still important components of a Concept-Based Curriculum; however, the inclusion of concepts leverages student thinking and the retention of learning by bringing relevance to learning the skills and facts (Lanning, 2013). A conceptual structure for curriculum is key because conceptual understanding requires content knowledge, but the reverse is not necessarily true. By designing

curriculum in this manner, teachers are clear about the concepts and understandings that students must master each year.

But curriculum materials are seldom designed to set up this intellectual synergy systematically. Though concepts are mentioned, and often defined, they appear to be "Oh, by the way. . ." afterthoughts that one might want to consider. A Concept-Based Curriculum design provides teachers with clear targets for what students will come to understand, so educators can become more deliberate in creating lessons that advance an interplay between concepts and knowledge or skills, or what we are calling synergistic thinking. 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 basic curriculum materials so they support deeper understanding. How? Using the essential concepts of a discipline to organize and prioritize information enables teachers to chart a pathway for students' thinking. John Hattie says that often we need to be taught a "coat hanger" (or higher-order concept) on which to hang new knowledge (Hattie & Yates, 2014, p. 115). The mind does not relate well to unstructured data. The conceptual lens uses an idea or concept (generally a macroconcept) to bring focus and depth to a study, facilitating the transfer of understanding and ensuring synergistic thinking (Erickson, 2008 p. 105). In Concept-Based Curriculum, the conceptual lens is that first "coat hanger." Teachers use a conceptual lens to invite students to bring their own thinking to the study at hand.

Let's look at an example of how a conceptual lens works. 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* and *inhumanity.*

This conceptual lens is the vehicle that sets up a synergy between the lower 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.* In order to activate this intellectual synergy, Janet uses guiding questions throughout her instruction. Concept-Based teachers learn about three different types of questions (factual, conceptual, debatable) and how to use them flexibly throughout instruction to guide students' thinking from a specific topic or example to deeper conceptual understanding. Guiding questions will be discussed in more detail in Chapter 2, but let's look at a few that might be used in this particular lesson.

Factual Questions:

Why was the Holocaust a significant event in world history?

What beliefs did the Nazi's hold that drove their actions?

What events led to the rise of Hitler's power?

Conceptual Questions:

How do economic, political, and social conditions shape views on humanity and inhumanity?

Why does silence often contribute to acts of inhumanity?

How are personal beliefs, values, and perspectives related to views of humanity and inhumanity?

Debatable 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 process intellectually 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 curriculum writers could decide collaboratively to use to engage a student's conceptual mind. This list isn't exhaustive; teachers could choose a conceptual lens closely connected with their discipline. The focus a teacher wishes to bring to a study suggests a particular lens, so we almost always start with the unit title and then select the lens. Notice that some of the lenses in Figure 1.2 are very broad and abstract (macroconcepts),

FIGURE 1.2: SAMPLE CONCEPTUAL LENSES

Conflict	Complexity
Beliefs/Values	Paradox
Interdependence	Interactions
Freedom	Transformations
Identity	Patterns
Relationships	Origins
Change	Revolution
Perspective	Reform
Power	Influence
System	Balance
Structure/Function	Innovation
Design	Genius
Heroes	Utility
Force	Creativity

such as *system* or *change*, while others are more specific (microconcepts), such as *proportionality* or *heroes.* Again, the lens reflects the particular conceptual focus for the unit of study.

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

1. Think of two specific units from the curriculum you teach.
2. Choose a potential conceptual lens from the list in Figure 1.2 for each curriculum unit.

Now try changing the lens you selected for each unit to a different lens.

Notice how changing the lens changes the focus for thinking about the learning.

Which lens do you think would be most engaging (or challenging) for students?

Unit of Study	*Potential Lens*	*Potential Lens*
A.	1.	2.
B.	1.	2.

Thinking reflectively (metacognitively), did you notice how the conceptual 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?

FIGURE 1.3: CONCEPTUAL LENS

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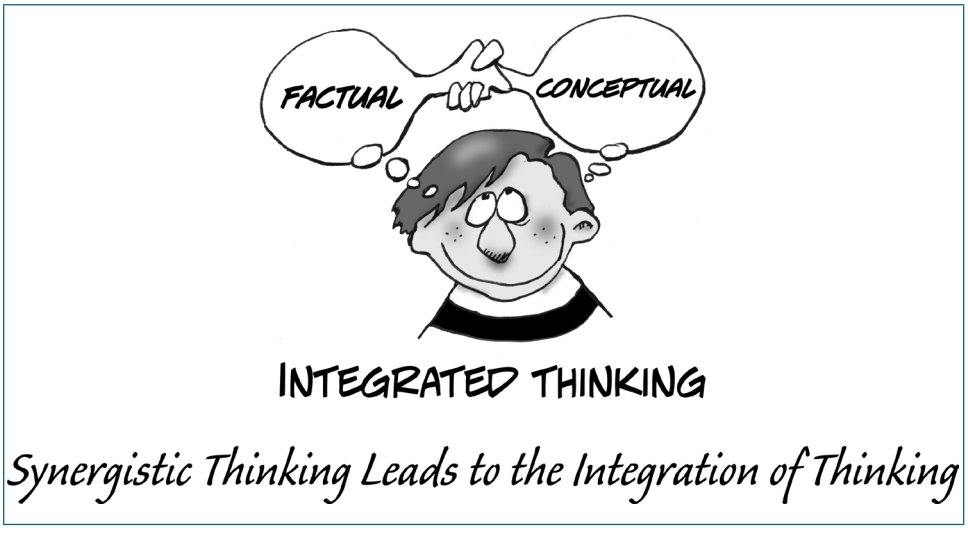
The Integration of Thinking

When we can rise above the facts and basic skills to see patterns and connections to related concepts, principles, and generalizations, and when we can understand the deeper, transferable significance of our learning, then we can say our thinking is *integrated* at a conceptual level. The integration of thinking needs to be a conscious design goal for curriculum and instruction.

Integration is a cognitive process rather than how we organize subjects in a curriculum unit (Erickson & Lanning, 2014, p. 84). Integration can occur in inter- and intradisciplinary contexts as long as there is a conceptual lens, or focus, that facilitates synergistic thinking—the interplay between the lower and higher orders of thinking. The process of thinking synergistically results in a cognitive integration, or synthesis of thought, which is exemplified by conceptual understandings that transfer through time, across cultures, or across examples. For example, the conceptual lens of *complexity* for a unit titled "Global Economics" invites students to think between specific facts related to global economics and the unit's conceptual lens, *complexity*. This process of thinking synergistically culminates in the construction of conceptual understandings that transfer through time. When students are able to articulate a generalization, such as "We understand that . . . international shifts in political power can realign economic relationships among affected nations," their synthesis of thought becomes visible and reflects the integration of thinking.

In addition to using a conceptual lens to integrate thinking, teaching inductively to conceptual understandings (generalizations and principles) also facilitates the integration of thinking. These conceptual ideas are commonly referred to as

FIGURE 1.4: INTEGRATED THINKING



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"enduring understandings" (Wiggins & McTighe, 2011), "essential understandings" (Erickson, 1995, 2002), or "big ideas" in today's education jargon. The International Baccalaureate (IB) refers to these conceptual understandings as "central ideas" and "statements of inquiry."

Consider this generalization: "Artists often use a combination of color harmonies to create emotional complexity." It is a synthesis of thought 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 Picasso's blue period. Chapter 2, "The Structures of Knowledge and Process," will discuss conceptual understanding in greater depth, stressing the significance for teaching, learning, and intellectual development.

The Transfer of Learning

The ability to transfer knowledge and skills to new or similar contexts is evidence of deeper understanding and higher-order thinking. When discussing transfer, Perkins and Salomon (Lanning, 2009) made the distinction between an individual's learning traveling to a new context in terms of "near (or low road) and far (high road)" transfer. When problems and tasks are so much alike that the transfer of learning occurs fairly readily, it is considered *near transfer*. For example, the skills of driving a car transfer to driving an unfamiliar truck. *Far transfer* refers to the attempt to transfer learning from one context to another when the sense of connection between the two learning situations requires deeper thinking, knowledge, and careful analysis. An example here is using one's knowledge of how electrical systems work to facilitate an understanding of the network of arteries and veins in the circulatory system (Lanning, 2009). This is the type of transfer that will best serve students as they navigate our complex world. Concept-Based Curriculum and Instruction (CBCI) is deliberately designed to facilitate high-road transfer and not leave it up to chance.

Concept-Based Curriculum and Instruction (CBCI) is deliberately designed to facilitate high-road transfer and not leave it up to chance.

Because the traditional coverage model of curriculum design values memorization over the integration of thinking and the transfer of learning, 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 transfer should be daily fare not the exception 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.

In Chapter 2 of the *Critical Thinking Handbook*, titled "Making Critical Thinking Intuitive," Richard Paul (Foundation for Critical Thinking) states that "intuitive understanding enables us to insightfully bridge the gap between abstract concept & concrete applications" (1997, p. 20). He calls on all levels of education to teach in a way that fosters intuitive understanding. As he 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. (Paul, 1997, p. 36)

We agree with Paul that too often there is a lack of intuitive synthesis in teaching and learning. Intuitive synthesis would be an important component in the integration of thinking. But we 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 too many schools continue to provide lower-level curricular materials, which do not support high road transfer. Some teachers overcome these realities by redesigning lessons and by extending their own understanding of sound pedagogy. It is also encouraging to see more schools working to build conceptual structures in their curricula and instruction. These teachers and schools are still not the norm, however, which is in part why we see such disparity in student achievement.

Developing the Intellect

Intellectual Character and Dispositions

Schools play a critical role in the development of the intellect. But as Ron Ritchhart so aptly observes in *Intellectual Character* (2002),

> school . . . [is] more about style than substance, breadth than depth, and speed above all else. . . . we've come to mistake curriculums, textbooks,

> standards, objectives, and tests as ends in themselves rather than as means to an end. (pp. xxi, 8)

Ritchhart (2002) cautions that we are teaching for the wrong thing—that we need to keep our focus on the nurturing of "intellectual dispositions" that develop strong "intellectual character" (p. 10). Ritchhart 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).

Information without intellect is meaningless.

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 CBCI provides a powerful frame for the development of these intellectual dispositions.

1. Creative Thinking

The area of creative thinking is fascinating because it is the ultimate expression of reflective and critical thinking. Creative thinking becomes increasingly important in a world dealing with complex problems. Today, however, educators are becoming ever more concerned about the narrowing of school curricula as a result of the emphasis on high-stakes testing. We agree with these concerns! CBCI prepares students for the expectations of new standards without sacrificing students' creative thinking.

Sometimes people do not understand what creative thinking really entails and thus dismiss it as nonessential to schooling. To help us better explain the value of creative thinking, we turn to Ron Ritchhart, who 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.

FIGURE 1.5: CREATIVE THINKING

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Another noted author who delves deeply into creativity is Sir Ken Robinson. Robinson's 2006 TED Talks, *Do Schools Kill Creativity*, is one of the most viewed discussions on creativity. The ideas he spoke to at that time remain highly relevant today. One of his contentions is that creativity is as important in education today as literacy, and schools should treat creativity with the same status. Unfortunately, recent educational policies are causing instruction to move further away from this notion. Robinson maintains that, if you aren't prepared to be wrong, you'll never come up with anything original. Tasks, classroom discussions, and assessments that only reward right answers versus thinking, produce learners who are afraid to be wrong. Robinson cautions he is not saying that being wrong is the same thing as being creative:

> What we do know is, if you're not prepared to be wrong, you'll never come up with anything original. . . . We stigmatize mistakes. And we're now running national education systems where mistakes are the worst thing you can make. And the result is that we are educating people out of their creative capacities. . . . I believe this passionately, that we don't grow into creativity, we grow out of it. Or rather, we get educated out of it.

We're also not saying that wrong answers as a final result are okay. What CBCI promotes are opportunities for students to think, process, synthesize, discuss, and make mistakes as a natural part of their learning; in other words, this approach allows a role for creative thinking in the learning process. The teacher's responsibility is to guide students' thinking productively by coaching, questioning, giving meaningful

feedback, and designing tasks that advance thinking as much as an understanding of the content to be learned. Ultimately, we want students to construct understandings that reflect the important, transferable ideas under study but also to understand how they arrived at these understandings.

Though all disciplines benefit from the use of creative thinking in problem solving, it is a wellspring for the arts. Whereas science helps people understand and explain phenomena in the natural and constructed world, the arts go a step further and allow students to create and share personal interpretations of the physical and sociocultural world. It is alarming, therefore, to see schools cutting out art programs to make more time for drill and kill.

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 of unique and innovative products, cultural expressions, and solutions to global problems.

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Of all the disciplines, the arts are the most open ended. Though there is a formal structure of concepts and principles that provide the language of the craft and critique, the arts stimulate 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 the arts have intrinsic value as a personal and social expression of culture and emotion, the place for the arts in school has heightened importance today as a powerful vehicle for developing creative thinking. As Robinson (2013), again, informs us, "the arts aren't just important because they improve math scores. They're important because they speak to parts of children's being which are otherwise untouched." The future of our world depends on the marriage of creative, critical, conceptual, and reflective thinking. No doubt about it.

2. Critical Thinking

What is critical thinking? There are many definitions, but we like that of Ron Ritchhart (2002, p. 29), which includes the dispositions of "seeking truth and understanding, being strategic, and being skeptical" as components of critical thinking. Who can argue that these attributes are not fundamental to navigating the present day successfully? 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 for and the validity of 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

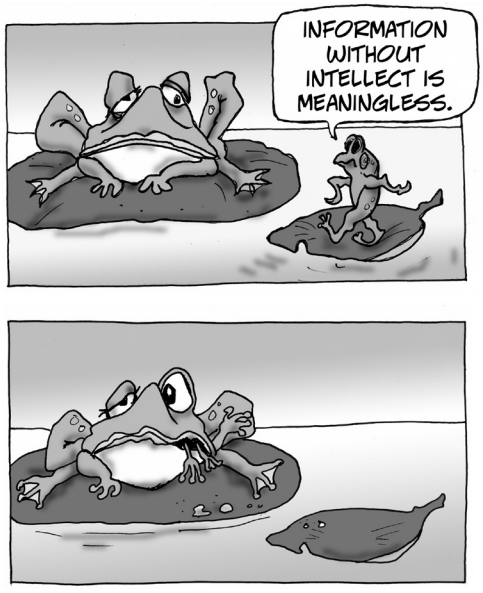
personal bias into the evaluation of a situation, and attempt to hold their biases in check as they consider the evidence. Critical thinkers use logic to solve problems. They plan strategically for dealing with the issue by clarifying the problem and its components, by considering the viability of alternative solutions, and by laying out a time line and set of steps to achieve resolution.

Critical thinkers know the value of different types of thinking. So what kinds of thinking are of value? This is a question Ritchhart (2015) poses and answers:

> Naturally, this depends on the learning context, but broadly speaking we want students to become proficient with the kinds of thinking they can use to develop their own understanding of things.
>
> For example:
>
> - Asking *questions*, identifying puzzles, and wondering about the mysteries and implications of the objects and ideas of study
> - Making *connections,* comparisons, and contrasts between and among things—including connections within and across the discipline as well as with one's own prior knowledge
> - Building ongoing and evolving *explanations*, interpretations, theories based on one's ever-developing knowledge and understanding
> - Examining things from different *perspectives* and alternative points of view to discern bias and develop a more balanced take on issues, ideas, and events
> - Noticing, observing, and *looking closely* to fully perceive details, nuances, and hidden aspects and to observe what is really going on as the foundational evidence for one's interpretations and theories
> - Identifying, gathering, and *reasoning with evidence* to justify and support one's interpretations, predictions, theories, arguments, and explanations
> - Delving deeply to *uncover the complexities* and challenges of a topic and look below the surface of things, recognizing when one has only a surface understanding
> - Being able to *capture the core* or essence of a thing to discern what it is really all about (pp. 31–32)

In the end, students need to understand what it takes to be a critical thinker, and learning experiences that require critical thinking need to be embedded in every subject area. Without knowing all the dispositions of critical thinking, students are at risk of easy manipulation and shallow understanding.

FIGURE 1.6: INFORMATION WITHOUT INTELLECT



SOURCE: David Ford Cartoons, davidford4@comcast.net.Used with permission.

3. Reflective (Metacognitive) Thinking

Richard Paul and Linda Elder are known as prominent authorities on critical thinking. One of their greatest contributions to the area of critical thinking is a set of intellectual standards, provided in *The Miniature Guide to Critical Thinking*: *Concepts and Tools* (Paul & Elder, 2014, pp. 12–13). The journey of conceptual thinking, as well as the other kinds of critical thinking, requires ongoing metacognitive work.

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.

Again, the message we want to convey is that developing students' thinking is as much a learning target as the content to be grasped. Concept-Based Curriculum and Instruction (CBCI) enables this two-pronged goal to become a reality. It's one thing for us as teachers to articulate the kinds of thinking we are seeking to promote; it is another for students to develop a greater awareness of the significant role that thinking plays in cultivating their own understanding. Too often, students don't have much knowledge of the strategies they might employ to facilitate and direct their thinking—this is especially true for students who find learning a struggle. Without this knowledge, they are likely to be less effective, less independent, less engaged, and less metacognitive as learners (Ritchhart, Church, & Morrison, 2011).

FIGURE 1.7: QUESTIONS FOCUSED ON INTELLECTUAL STANDARDS

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?

SOURCE: Paul, R. W., & Elder, Linda. (2012). *The Thinkers Guide to the Nature and Functions of Critical and Creative Thinking*. Tomales, CA: Foundation for Critical Thinking. www.criticalthinking.org. (Originally published in 2004) Used with permission.

4. Conceptual Thinking

Though Ritchhart 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 examine factual information critically, relate new learning to prior knowledge, see patterns and connections, draw out significant understandings at the conceptual level, evaluate the truth of these understandings based on the supporting evidence, transfer understandings across time or situation, and, often, use a conceptual understanding creatively to solve a problem or invent 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.

Students' thinking is inevitably directed by the messages we send about the value of thinking. The questions we raise and the questions students seek to investigate provide opportunities to spotlight how one might think through a problem, issue, or difficult content. We are well advised to help students learn how to become independent analyzers, problem solvers, and thinkers. By explicit modeling and by designing learning tasks that require intellectual work, we not only help them take command of their thinking in a general way, we also provide a vehicle that enables them to evaluate their reasoning effectively and critically and to make connections between and among ideas, situations, and examples.

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. In discussions with many art professionals, we hear a common conviction about the relationship of disciplinary depth to quality problem solving. CBCI emphasizes the importance of systematically building knowledge, conceptual understanding, and processes and skills *by discipline* through the grades. Art teachers agree—often telling us that students' patterns of behavior, thinking, and interacting derived from deep and personal learning experiences result in 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.

Many other subject area specialists also advocate for a curriculum and instructional design that gives students the experience of being "practitioners" in a discipline. This means that teachers must become familiar with the disciplinary ways of knowing, understanding, and doing so they can design subject area learning experiences that develop these unique approaches to problem solving and insight. This does not mean that students have to always learn in disciplinary "boxes." On the contrary, there are times for examining problems and issues through *interdisciplinary* perspectives to give 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 and skills in their subject area and grapple with the "How?" "Why?" and "So What" of the content they are teaching. 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, we wondered why teachers showed so much enthusiasm in workshops after expressing how hard it was to think. And then it struck us—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.

Students feel personal satisfaction from using their minds well.

Sometimes, teachers enter our workshops eager to learn and feel validated for the Concept-Based pedagogy they already practice, yet they gain even deeper understandings and expand their practice as they journey forward. Other teachers may enter our workshops with negative preconceived notions, but when they see that facts and skills 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 this 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. Let's return to Elder and Paul's sage advice as a conclusion to this section:

> There are many ways to teach content so that students progress as thinkers. However, if we are to do so, we must explicitly focus on the mind intellectually and grasp the stages that students must progress through. We and our students must recognize that we all develop incrementally as thinkers, and that the progress of any one of us is directly dependent on our level of intellectual knowledge and commitment. Put another way, if I am to develop my critical thinking ability I must both "discover" my thinking and must intellectually take charge of it. To do this I must make a deep commitment to this end.
>
> Why is this so important? Precisely because the human mind, left to its own, pursues that which is immediately easy, that which is comfortable, and that which serves its selfish interests. At the same time, it naturally

resists that which is difficult to understand, that which involves complexity, that which requires entering the thinking and predicaments of others.

For these reasons, it is crucial that we as teachers and educators discover our own "thinking," the thinking we do in the classroom and outside the classroom, the thinking that gets us into trouble and the thinking that enables us to grow. As educators we must treat thinking—quality thinking—as our highest priority. It is the fundamental determinant of the quality of our lives. It is the fundamental determinant of the quality of the lives of our students. We are at some stage in our development as thinkers. Our students are at some stage in the development of theirs. When we learn together as developing thinkers, when we all seek to raise our thinking to the next level, and then to the next after that, everyone benefits, and schooling then becomes what it was meant to be, a place to discover the power of lifelong learning. This should be a central goal we help nurture in all our students: to begin, to practice, to advance as thinkers. (Elder & Paul, 2010)

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 twenty-first-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—where understandings can be transferred across cultures, to other situations, and to other times.

This chapter provided a very brief description of how the brain works and described the power of a conceptual lens to create a synergy between the lower and conceptual levels of thinking. This chapter also was about the development of thinking, and it valued the ideas of Richard Paul and Linda Elder and Ron Ritchhart, ideas that help students assess the quality of their thought processes using metacognition. Ron Ritchhart's ideas on "intellectual dispositions" pull together perspectives on critical, creative, and reflective thinking; we added conceptual thinking to his list. And finally, we offered a reminder 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 and process are structured and by illustrating the difference between the lower and conceptual levels of knowledge, thinking, and understanding.

Extending Thought

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 lower 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 conceptual transfer a key indicator of deeper understanding?
8. 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?
10. Why are the ideas presented in this chapter important to the future of our society and the world?