Learning Theory

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*Please visit the Resource Exchange on TFANet to access the **Learning Theory Toolkit,** which contains sample tools we've collected over time that are referenced throughout this text. You can also access many other tools on the Resource Exchange—from a wide range of grade levels and subject areas—which have been developed and shared by our corps members and alumni.*

Learning Theory
Related Readings 🕮

Please note: These articles can be accessed using the links provided below.

"Practice Makes Perfect – But Only If You Practice Beyond the Point of Perfection"
by Daniel T. Willingham
Go to: http://www.aft.org/newspubs/periodicals/ae/issues.cfm (select the **Spring 2004** issue)

"Allocating Student Study Time"
by Daniel T. Willingham
Go to: http://www.aft.org/newspubs/periodicals/ae/issues.cfm (select the **Summer 2002** issue)

"Students Remember…What They Think About"
by Daniel T. Willingham
Go to: http://www.aft.org/newspubs/periodicals/ae/issues.cfm (select the **Summer 2003** issue)

"Do Visual, Auditory, and Kinesthetic Learners Need Visual, Auditory, and Kinesthetic Instruction?"
by Daniel T. Willingham
Go to: http://www.aft.org/newspubs/periodicals/ae/issues.cfm (select the **Summer 2005** issue)

What Is Learning Theory?

Introduction

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> *Physicians cannot cure an ailment if they do not know how various organs and tissues work. In the same way, a teacher could not solve a learning or motivation problem without knowledge of how the mind works. Presenting an instructional method to a teacher without giving him or her knowledge of the mind is like presenting a drug therapy to a physician without explaining how the drug operates with the body. The more mysterious a therapy or instructional program is (e.g., "It works, but I don't know why"), the more likely it is to be used ineffectively or inappropriately.*[1]

Over the last several decades, opinions on "how to teach" have swayed back and forth from a focus on teachers' methods and approaches to one that includes considerable attention to students' reception of those methods and approaches. In recent years, we have developed a better understanding of the value of "learner-driven" teaching—an approach to classroom instruction and management that purposefully begins with what we know about our students' strengths, weaknesses, thought processes, cognitive development, learning styles, interests, behaviors, and learning differences in hopes of ensuring that our instruction and management are designed purposefully to lead our students to academic success most efficiently.

A number of trends are contributing to this push toward "learner-driven" education:

- **Accountability for student learning.** The growing emphasis on teachers' and schools' accountability for student learning has given new energy to the quest to study systematically which methods and approaches are "working" and which are not—an inquiry that recognizes student learning (rather than teacher mastery or student engagement) as the ultimate measure of an instructional method's success. The U.S. Department of Education, for example, created the "What Works Clearinghouse," which aims to be a central source for scientifically-supported best practices.[2]

- **Advanced research methodologies.** To a greater extent than ever before, rigorous research methodologies—often developed in other areas of social science—are being applied to the evaluation of pedagogy, leading us to greater insights about how children at different ages best process information, interact with others, catalog new knowledge, etc.

- **Learning differences.** The last two decades have seen a marked increase in society's basic understanding (and schools' legal responsibility) regarding learning differences, a trend that encourages us to think critically about how our generic instructional methods and management strategies are received differently by individual minds.

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[1] Byrnes, James P. *Cognitive Development and Learning In Instructional Contexts*, 2d Ed. Allyn and Bacon: Boston, 2001, p. xiii

[2] What Works Clearinghouse website, http://ies.ed.gov/ncee/wwc/, accessed 7/1/2010.

- **Neuroscience and cognitive research.** Significant advancements in neuroscience and cognitive research have altered the way we conceive of human understanding, though scholars acknowledge that we are only beginning to uncover the processes in the brain underlying how we think and learn.

The result of all of these interconnected trends is a realization by educators that we have an obligation to know how our students learn so that we can more effectively and efficiently teach them. As one education expert explains, "when teachers have a thorough understanding of how the brain develops, learns, and organizes itself, they will make better decisions about teaching, and will use programs such as multiple intelligences, learning styles, and cooperative learning more effectively."[3]

I. Implications of Learning Theory

This text on Learning Theory will provide you with some basic background about how students learn. We hope that this background will inform your thoughts about each of the other texts you will read this spring, especially *Instructional Planning & Delivery* and *Classroom Management & Culture*. For example, the information discussed here may provide insights into the following questions:

- My school just switched me from fifth grade to second grade. Will the same rules and consequences that I used with fifth-graders work with second-graders? How should I adjust them to match a second-grader's understanding of rules and consequences?

- In drafting my objectives from my state standards, I find myself consistently teaching to a relatively superficial level of understanding. I know I want to take my students beyond rote memorization. How can I best teach my students concepts, taking them into the realm of higher-order thinking?

- I know from my own school experience that not all students learn the same way. But now that I am a teacher, in what ways should I consider adjusting my lesson planning so that I am sure that I am reaching all students?

- I have three students with learning disabilities in my classroom, one of whom is also diagnosed with Attention Deficit/Hyperactivity Disorder. How should that fact affect my instruction for those students and for the whole class?

- One of my students is homeless and seems to come to school hungry and sleepy every day. These problems are clearly interfering with his ability to learn. What should I do to address those problems? What is my role? How will these challenges affect our goals for his academic achievement?

[3] Sousa, David. "Is the Fuss About Brain Research Justified?" *Education Week*: Vol. 18, No. 16; December 16, 1998, p. 52.

II. An Overview of This Text

Chapters One and Two. In Chapter One of this text, we will explore several of the most basic—and most commonly used—models for thinking about thinking and learning, including Bloom's Taxonomy and theories of multiple intelligences and learning modalities. In Chapter Two, we will survey childhood and adolescent cognitive development, highlighting the implications of that information for instructional planning and classroom management. Both of these chapters are designed to give you insight into (and a model for thinking about) what is happening in your students' minds and how you can adjust your instruction to match your students' mental processes.

Chapter Three. In the third chapter, we will explore learning differences that students bring to your classroom, highlighting particular conditions and diagnoses that almost all teachers encounter in their classroom, including Attention Deficit and Attention Deficit/Hyperactivity Disorders (ADD and AD/HD), emotional disturbances, and various learning disabilities. Chapter Three will also provide tips for adapting instruction for students who learn differently from other students in your classes.

Chapters Four and Five. Chapters Four and Five highlight the insights of learning theory into two aspects of instructional planning and implementation that new teachers often find most challenging. First, in Chapter Four, we discuss what it means to "get in your students' minds" as you lesson plan so that you are ensuring that optimal learning occurs. To that end, we will discuss what it means to "explain" a concept and survey several student-driven strategies for enhancing learning. Then, in Chapter Five, we will focus on the challenges posed by—and benefits of—teaching beyond lower-order objectives to higher-order concepts and processes.

Chapter Six. Finally, in Chapter Six, we will take a step back and consider student-centered issues at the very foundation of learning theory—your students' physical and emotional readiness to learn. Some teachers—especially those teaching in high-poverty areas—find that accessing resources to address students' extra-academic needs can be a critical component of their relentless pursuit of academic achievement. This chapter will survey some of the health-, safety-, nutrition-, hygiene-, and sleep-related challenges that some students may bring to your classroom, and we will make suggestions on how to address them.

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Thus, this text will provide an overview of a wide range of topics related to how students learn. The ultimate purpose of this text, however, is not actually to ensure that you memorize all of this information, but rather to ensure that you, as a teacher concerned with leading your students to academic achievement, are customizing your instruction and management strategies to impact your students' learning most effectively.

Thinking About Thinking and Learning

Chapter One

I. Bloom's Taxonomy of the Cognitive Domain
II. Multiple Intelligences and Learning Modalities
III. Memory Theory

Introduction

As you might imagine, hundreds and hundreds of books have been written on learning theory, each representing a different collection of approaches and angles on a complex body of research and hypotheses about how our brains receive, organize, process, and remember information.

With the acknowledgement that we will barely scratch the surface of all that it is known (and supposed) about this topic, we have selected several sets of concepts that fall under the general umbrella of learning theory that we believe are extraordinarily useful for new teachers. These four ideas—Bloom's Taxonomy of the cognitive domain, multiple intelligences and learning modalities, basic theories about memory, and cognitive development—will provide you with a foundation that will inform everything you read and learn as you work to become a highly effective teacher. For the sake of clarity, we will address the first three ideas—Bloom's Taxonomy, multiple intelligences and learning modalities, and memory theory—in this chapter, and we will save the fourth idea, cognitive development, for Chapter Two.

Here is brief preview of the ideas (and their utility) that we will address in this chapter:

Concept	What Is It?	Relevant Questions
Bloom's Taxonomy	A way of thinking about the increasingly demanding levels of learning that you may expect from your students	• How demanding are my objectives? • Do I teach students to memorize the Pythagorean theorem the same way I teach them to prove it?
Multiple Intelligences & Learning Modalities	Frameworks for thinking about how teachers can best present material	• Should I make a visual aid for this lesson? • Should I be concerned that my students are seated the entire period, every day?
Memory Theory	What we know about how our brains collect and store information	• Why did my students lose all memory of what we studied yesterday? • Why did I?

I. Bloom's Taxonomy of the Cognitive Domain

If you have taken an educational psychology course in college, you may recall that in the 1950s Benjamin Bloom and his colleagues developed a classification hierarchy for types of knowledge, cognitive processes, and skills. Bloom's Taxonomy has had a profound effect on education and educators, as it provides a mental model for thinking about the relative difficulty of different objectives that students are expected to master and provides guidance for how teachers should approach and assess various objectives.

Thinking About Thinking and Learning

Bloom's hierarchy is based on six levels of cognition that increase in difficulty and in complexity, from basic knowledge of a specific fact (which is the first level) to evaluative judgment of some concept or knowledge (which is the sixth).

Six Levels of Cognitive Understanding

Consider the following table charting the definitions and providing examples for each level:

Level—and Associated Performances	**Definition**	**Example 1** *The student will be able to (SWBAT)...*	**Example 2** *The SWBAT...*	**Example 3** *The SWBAT...*
(1) Knowledge— write, list, label, name, state, define	• Restating information the way it was taught • Knowing information in a merely rote-learned way	Define the six levels of Bloom's Taxonomy of the cognitive domains	State the Pythagorean Theorem	From a list, identify three words that start with the /sh/ sound
(2) Comprehension— explain, summarize, paraphrase, describe, illustrate	• Interpreting and translating concepts and ideas from someone else's definition into your own	Explain the purpose of Bloom's Taxonomy	Discuss the uses of the Pythagorean Theorem	Explain what happens when an "s" and an "h" are put together
(3) Application— use, compute, solve demonstrate, apply, construct	• Applying definitions, formulas, principles to real world problems • Generalizing and using abstract information in concrete situations	Write an instructional objective for each level of Bloom's Taxonomy	Use the Pythagorean Theorem to figure out a distance from one spot in the parking lot to another	Write a sentence using two words that start with /sh/
(4) Analysis— analyze, categorize, compare, contrast, separate	• Breaking complex information into component parts and seeing how those parts are interrelated	Compare and contrast the cognitive and affective domain	Analyze the Pythagorean Theorem's applicability to non-right-triangles and explain why it does not apply	Compare words that start with the "s" to words that start with "sh"
(5) Synthesis— create, design, hypothesize, invent, develop	• Building a more complex result from a set of components • Putting together parts to form a whole	Design a lesson plan that incorporates each of Bloom's levels of cognitive understanding	Prove the Pythagorean Theorem	Create words that start with the /sh/ sound when given a series of word endings (-ut, -out, -ip)
(6) Evaluation— judge, recommend, critique, justify	• Judging something against a standard of quality	Judge the effectiveness of writing objectives using Bloom's Taxonomy	Evaluate and critique Pythagoras' original proof of the theorem	Evaluate the English system of spelling and inefficiencies related to the /sh/ sound

Despite considerable research in this area, for almost five decades Bloom's taxonomy has remained impervious to alternative models. In fact, most new research continues to validate this taxonomy. (There is some disagreement among learning theorists, however, as to whether the order of "synthesis" and "evaluation" should be switched on the grounds that evaluation may be less difficult to accomplish than synthesis. This dispute only affirms that the taxonomy should not be confused for a strict hierarchy; while higher-order objectives require definitional knowledge, you need not require your students to complete synthesis tasks before attempting evaluation.) Perhaps the key to its resiliency over the years is Bloom's Taxonomy's unquestionable usefulness for teachers.

Implications of Bloom's Taxonomy for Teachers

Generally speaking, Bloom's Taxonomy gives teachers a useful vocabulary for discussing their learning objectives. More specifically, Bloom's Taxonomy serves teachers by (1) helping them push students toward deeper understanding, (2) providing them insight into how to order objectives, and (3) revealing the best ways to teach a given objective.

(1) Bloom's Taxonomy illuminates the path to deeper understanding. This six-level model for thinking about knowledge gives us a gauge for determining the rigor of the learning objectives that we have for our students. Not all thinking requires the same amount of work. To commit the first seven digits of pi to memory is a qualitatively different endeavor than understanding that pi is the constant ratio between the circumference of a circle and the square of its radius. Knowing that pi *is* that ratio is qualitatively different still from being able to prove the truth of pi yourself. Or, to use another example, being able to sing or say the alphabet by rote is a far cry from recognizing the connection between the letter "k," the sound /k-/, and the written letter's role in the word "kite." Once we appreciate this taxonomy, we recognize that students can "understand" a topic or subject on a whole range of levels, and we are better able to lead our students toward those higher, more engaged, levels of knowledge.

We want to push students "up" the knowledge hierarchy for at least three reasons. First, although studies indicate that most teacher-made tests continue to test at the lower levels of the taxonomy, researchers tell us that students have a more lasting memory of what they have learned if they engage with the subject matter at the higher (analysis, synthesis, and evaluation) levels. Second, the very cognitive skills required to operate at that high level of knowledge are the most transferable to other areas. For example, a student who can recite the pros and cons of some government policy decision (at the lowest, "knowledge" level) does not have the transferable benefits that he or she would develop during the process of *creating* those pros and cons (at the "synthesis" level). Finally, lower-level objectives have little use on their own in the real world. You may be able to define a simile, but can you choose the right one to make your writing shine like the brass section of the Boston Pops? Of course, lower-level objectives are fundamental to our instruction because they form the very basis of higher cognition. Good teaching encourages students to think and perform on a variety of levels of the taxonomy.

(2) Bloom's Taxonomy helps us logically sequence our objectives. An underlying premise of Bloom's model is that students do have to work their way up the ladder of cognitive domains. That is, a student who does not know the definition of a right triangle (knowledge level) cannot complete a proof of the Pythagorean Theorem (synthesis level). Thus, in a very tangible way, Bloom's Taxonomy helps us shape and direct our instruction. Given that each level of Bloom's hierarchy builds on the next, we are provided with a step-by-step, metacognitive model for designing lessons. Within a lesson and over time, purposeful teachers gradually push their students up Bloom's ladder. As one learning theorist explains:

> The developmental approaches of higher-order thinking stress the importance of following a sequence of fostering lower forms of thought before higher forms of thought.

> Students need considerable experience interacting with concrete content and solving problems in order to be able to form abstractions and develop mastery over this information. . . . According to developmental views, then, it is not a problem if preschool or early elementary teachers focus mainly on lower-level skills. The problem is that teachers of older students never go beyond fact-learning.[4]

(3) Bloom's Taxonomy provides insight into *how* to teach a given objective. As is discussed in some detail in the *Instructional Planning & Delivery* text, Bloom's Taxonomy is an invaluable tool for a teacher considering specific teaching objectives. If the teacher is designing objectives (the daily end-goal of a lesson) from some general learning standards (the grand curriculum expectations for the year set by the state), Bloom's hierarchy provides a set of choices for the teacher so he or she can choose an appropriately rigorous objective.

We got really in to Bloom's Taxonomy— it was posted on the classroom wall, and every now and then I'd ask someone to categorize a question or assignment. My 6th graders got psyched up for the SYNTHESIZE and EVALUATE questions, and were more willing to "dig deep" to answer them. Plus, I couldn't slide by with too many easy-to-plan lower-level assignments— they'd catch me every time!

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At the same time, if the teacher is contemplating *how* to teach a given objective, Bloom's Taxonomy assists the teacher in thinking about how to design a lesson. Perhaps, for example, a teacher is given the following objective by her district curriculum: "The student will be able to construct a five-sentence paragraph with a topic sentence and a summation sentence." The verb "construct" immediately tells the teacher that her students' ability to define a paragraph, or a topic sentence, is not enough. In fact, even her students' ability to describe in detail *how* to write a five-sentence paragraph is not enough. The teacher's students are expected to bring together all of what they know about topic sentences, supporting details, transition words and conclusions to *create* a paragraph themselves (a synthesis-level demonstration of knowledge).

Because we recognize that different levels of cognition lend themselves to different forms of teaching, Bloom's hierarchy gives guidance for how to teach a lesson.

> Bloom and his colleagues were quite helpful in pointing out the connection between teaching objectives and teaching approaches. In particular, if one wants students to know information at the knowledge level, one can simply use a drill and practice approach. In contrast, if one wants students to know information at the comprehension level, they must be taught in ways which help them understand better (e.g., using analogies). Similarly, if teachers want students to be able to apply information, they must show students how to apply information and give them multiple opportunities to apply what they know. Students who are just taught facts (e.g., the definition of a "democracy") cannot immediately apply this information (e.g., recognize a democracy when they see one; take a non-democracy and change it into one).[5]

Having read this explanation, you may find it helpful to return to the table of Bloom's levels and examples above. Each of those three sets of examples illustrate how a teacher can address the same content in different objectives, each objective requiring more rigorous thought by students as the objectives climb

[4] Byrnes, James P. *Cognitive Development and Learning In Instructional Contexts*, 2d Ed. Allyn and Bacon: Boston, 2001, pp. 90-91.
[5] Byrnes, James P. *Cognitive Development and Learning In Instructional Contexts*, 2d Ed. Allyn and Bacon: Boston, 2001, p. 91.

the ladder of Bloom's Taxonomy. Again, it is important to highlight that the practice of lower-level objectives, such as memorizing multiplication tables, should not be considered shallow in and of itself. Practice is vital so that accessing basic facts and skills can become automatic, making room for higher-level processes. The problems begin when teachers spend all of their time drilling their students and never take those basic concepts and skills to the next level.

II. Multiple Intelligences and Learning Modalities

A second realm of learning theory that is particularly helpful to new teachers involve the ideas of multiple intelligences and learning modalities, which are frameworks for thinking about the most student-friendly ways to communicate new knowledge. If a teacher understands the appropriate methods for communicating a given objective, the teacher can be sure to maximize the impact of a lesson by introducing new knowledge in those formats.

Multiple Intelligence Theory

While the proposition has since evolved into a range of theories, in the early 1980s Harvard researcher Howard Gardner made a permanent impression on pedagogical theory by asserting that the concept of "intelligence" is actually a conglomeration of a number of different intellectual aptitudes. Gardner proposed that there are actually seven intelligences, and that each of us possesses some combination of relative strength in each of those several categories. This idea countered traditional measures of intelligence (IQ tests, etc.) that focused primarily on the linguistic and logical modes of thought and processing.

Those original seven "intelligences" are linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, intrapersonal, and interpersonal. While researchers (including Gardner) have continued to propose variations on this list, the basic idea—that there is not just one type of intelligence—has significantly impacted education. This notion that each student has a unique combination of strengths and weaknesses, and that teachers can capitalize on those diverse strengths to enhance learning, underlies the strong push for teachers to differentiate instruction to meet the academic needs of their students.

Gardner is not without his critics. Describing the theory as a way to make every child feel special, some educators and researchers believe that calling these areas "intelligences" has conferred on them a special meaning that would not have been considered revolutionary had they simply been called "talents." Opponents of the theory and how it is commonly applied to classroom instruction say that no compelling research suggests that teaching to multiple intelligences is an effective strategy. In fact, Gardner himself shies away from making pedagogical recommendations based on the multiple intelligences, a point that may surprise many classroom teachers. Those who shape their lessons to fit Gardner's theories are going too far according to Daniel Willingham, a professor of cognitive psychology at the University of Virginia. Willingham says the idea of teaching children who possess "bodily-kinesthetic" intelligence how to spell by forming letters with their bodies, or expecting students to learn mathematical concepts simply by setting them to music, is ludicrous. Students in mathematics need to learn how to think mathematically, not musically, Willingham argues. And Gardner agrees. You might draw in a musical child with music, but true mathematical thinking doesn't really begin until you start teaching math.

While the educational community continues to debate the finer points of Gardner's ideas, it is nevertheless valuable for all teachers to think about the aptitudes that they may favor, or ignore, in their students. The strengths and weaknesses of your students in these aptitudes can influence the ease with which they master particular objectives, complete various tasks, or participate in the classroom

community. Recognizing that your students, in concert, may differ in these intelligences will push you to adjust your instruction so that each child in your classroom is given the necessary support and attention to develop both their stronger and weaker skills. To return to our previous example, rather than simply teaching a musically inclined (but less mathematically inclined) student the process of long division through a song, you will need to increase the amount of mathematics instruction and practice you give to this student in order to build his mathematical muscle. To help you recognize the various intelligences students might possess, consider the following table.

Intelligence	Description of Person with this Strength
Linguistic (includes phonology, syntax, semantics, language pragmatics)	• Has sensitivity to the meaning and order of words and the varied uses of language • Has highly developed auditory skills • Enjoys reading and writing • Has good memory • Spells words easily and accurately • Uses language fluently • (Probably the most universal of the intelligences)
Logical-Mathematical Intelligence	• Has ability to handle long chains of reasoning and to recognize patterns and order in the world • Explores patterns and relationships • Likes to problem solve and reason logically • Follows sequential, logical directions • Enjoys mathematics • Uses experiments to test things out
Spatial Intelligence	• Has ability to perceive the visual world accurately • Enjoys art activities • Reads maps, charts, and diagrams • Thinks with images and pictures • Does jigsaw puzzles
Musical Intelligence	• Has sensitivity to pitch, melody, and tone • Is sensitive to sounds in his or her environment • Enjoys music • Listens to music when studying and/or reading • Taps or hums rhythms
Bodily-Kinesthetic Intelligence	• Has fine-tuned ability to use the body and to handle objects • Processes information through body sensations • Requires hands-on learning • Moves and acts things out • Uses body in unique and skilled ways and is often well coordinated
Intrapersonal	• Has direct access to one's own "feeling life" • Has strong self-awareness • Prefer inner world, to be alone • May be introverted
Interpersonal	• Has ability to notice and make distinctions between others • May be extroverted • Focuses on relationships

For tools to use with your students that will determine their intelligences, please see the **Learning Theory Toolkit** (pp. 1-2: "Identifying Your Multiple Intelligences"); this Toolkit can be found online at the Resource Exchange on TFANet. Also available in the Toolkit (p. 3) is a "Multiple Intelligences Product Grid" that categorizes classroom products that appeal to different intelligences. 🛠

Learning Modalities

A concept closely related to multiple intelligence theory is the notion of "learning modalities" (or "learning styles"). A learning modality is one of three senses through which students most readily input information.

- **Visual Modality.** As its name states, the visual modality involves taking in information by seeing it. Some students say that they are "visual learners" and remember a concept or fact best when they can recall a page in their textbook, or a drawing on the board. Text, diagrams, photographs, charts, graphs, and maps are all tools that aid visual learning.

- **Auditory Modality.** A modality that you may find your students need to develop, auditory learning emphasizes what is spoken and heard. Students must focus on listening when teachers lecture, lead a discussion, read aloud, or play music. Some students' auditory modality is so sensitive to noise that these learners cannot work unless it is quiet.

- **Tactile/Kinesthetic Modality.** Often forgotten is the tactile/kinesthetic modality, which emphasizes the need to touch objects and move one's body. An elementary literacy teacher might have students draw letters in the air with their finger as they practice alphabetic recognition. A French teacher might use the Total Physical Response System to teach students vocabulary, connecting the new word "jete" (throw), for example, to the gesture of tossing an imaginary ball across the room. Experiments, textured manipulatives such as sand paper letters, use of props, and other opportunities for movement address the tactile/kinesthetic modality. Creating centers in your classroom may allow students to move around your classroom and help diffuse restlessness from remaining in one seat all day, but this is different from presenting information through the tactile/kinesthetic modality.

As with multiple intelligences, there are scholarly disagreements about applying these ideas to the classroom. While it is clear that there are many senses through which human beings can input information, some educational researchers and practitioners do not believe that individual students learn "best" in one way. In fact, some worry that learning modalities theory can be destructive since it may lead teachers to spend the school year planning outlandish math lessons with role-plays and dancing to enable kinesthetic learning, instead of practicing calculations. Students with strong tactile/kinesthetic perceptions can still learn with visual and auditory cues, so it would be incorrect to assume that you must figure out a way to incorporate every learning style into every lesson.

Many believe that the most useful way to think about modalities is to consider the *material* rather than the student. It is better to see a plant cell through a microscope or in a book than to hear a description of the cell wall. Similarly, it's better to listen to a recording of a symphony than to read about it. Total Physical Response is an effective way to help students link spoken words to their meaning, but at some point students also need to learn how to recognize these words on a page. Always think about learning modalities from a content perspective. What is the most appropriate approach to represent an idea? A math teacher might introduce the concept of fractions for the first time by dividing an orange into various sections, or having students attempt to divide a circle into equal parts. This approach simply best presents the concept of fractions.

Teachers often deliver instruction in one modality, and student recognition and recall improves when information comes in multiple forms. The key is to avoid relying too heavily on any one modality, as your students will benefit from getting material from a variety of angles.

III. Memory Theory

Another arena of learning theory that offers immediately practical knowledge for teachers is the study of human memory. Among the many fruits of cognitive psychology has been a more complete understanding of how the brain receives and stores information. That understanding can be translated into specific tips for teachers who are interested in ensuring that their students are not only receiving information but are also transferring it from short-term to long-term memory.

Cognitive psychologists describe two types of memory: working memory and long-term memory. "Working memory," also referred to as "short-term" memory, is the component of memory where new information stays while it is mentally processed. We can think of this memory as a temporary holding bin for incoming information. We do most of our thinking and processing of information that is in that "bin," as we make sense of a movie, have an argument, or shop for groceries. It's the place we temporarily store the phone number of the pizza place. Information stays in working memory, however, only as long as it is being actively used. Get interrupted in between looking up the phone number and actually dialing it, and you'll find yourself needing to look it up again.

"Long-term memory," on the other hand, is the final storage component of the memory system that holds information for some longer period of time—perhaps a day, a week, a month, a year, or one's entire lifetime. Because working memory has limited capacity, the goal is to learn facts and procedures well enough to store them in long-term memory, making them automatic and freeing up working memory for other things. Some people cannot learn to drive with the radio on; they need some time and practice before they can belt out "Build Me Up Buttercup" while switching multiple lanes on the interstate. (Researchers disagree about why information in long-term memory can fade, but that's a whole other story.) Not surprisingly, when you use knowledge frequently, it's likely to enter long-term memory.

Cognitive science also emphasizes for teachers the all-important role of the input stream for building memory. In teachers' language, that refers to students' attention to the material being presented. Teachers know that given all of the stimuli available to a student's mind in class, it is imperative that they work to focus students' attention on the "input" that the teacher is trying to "transmit" to the students' minds.

Strong teachers develop an extensive repertoire of techniques for assuring the deep, long-term internalization of the concepts they are teaching. Although not all of the following strategies will always apply to all kinds of knowledge, as a general matter, teachers can move information from working memory to long-term memory through:

- **Varied, Repeated Rehearsal.** Practice matters. Practice matters. Practice matters. Repeated rehearsal of information, preferably in a number of different contexts and in a variety of ways, helps to transfer it to long-term memory. Most district curricula are "spiraled," building in times to return to key points. Your long-term plan should also allow for periodic rehearsal of past objectives.

- **Building Connections to Prior Knowledge.** Students remember knowledge longer and more completely if they learn it in a meaningful context with which they are familiar. As you plan instruction, consider carefully what your students already know about the new information. Math teachers might begin a multiplication unit by highlighting instances when addition becomes inefficient. Social studies teachers interested in conveying the impact of the Bubonic Plague might draw parallels with the AIDS epidemic. English teachers might investigate the ways in which they can use the vocabulary students are learning in their

science class to teach word origins. In all cases, help students access that known information to provide a context and "resting place" for the new information. We'll discuss various means of connecting new information to students' prior knowledge in Chapter Four. Of course, this concept implies that students *have* prior knowledge, so it is always important for teachers to assess and build this base.

- **Organization.** We retrieve long-term memory through a pathway of associations. You might remember someone's name by associating it with that of a celebrity, or by going down the alphabet until you recall it. We can learn and remember a body of new information more easily when we organize it in some way. By categorizing information in meaningful ways, we create pathways to the new information that help us access it. You should encourage your students—through graphic organizers, tables, lists, etc.—to "bucket" information in a logical way. Both the process and the product of that organizing will help students remember the new information.

  As you know from your own experience, it is difficult to remember a number of disparate bits of information thrown at you at one time. Memory theorists point out that it is not necessarily the size of these "bits," but the number of them that trips up our memory. By placing these bits into larger "chunks" that are organized in ways that have meaning for us, we can remember them far more easily. For means of illustration, take three seconds to try to remember the 21 letters in each sequence below:

  1. HJAUIERYERWHABRBAGFCD
  2. GOAT JUMP TENT ASK RED SUM
  3. WARRIORS FOUGHT BRAVELY

  Clearly, we can remember the 21 letters much more easily when they are grouped meaningfully. By grouping ideas and creating categories, students have much less to remember, or at least have an automatic filing system for the data you want them to process.

  As an example, imagine that you are attempting to digest a huge mass of knowledge in preparation for a new job as a teacher of students who need considerable help immediately. If you were simply handed all of that information in an unorganized pile, you would have a difficult time accessing and remembering it. So, you might start "chunking" that information by thinking about it in different "folders" in your mind. Perhaps you could organize it as *Instructional Planning & Delivery*, *Classroom Management & Culture*, *Learning Theory*, etc. Then, within each of those "folders," you do another layer of mental grouping so that the mass of information in *Instructional Planning & Delivery* becomes another handful of mental "folders"—Assessment, Long-Term Planning, etc. These layers of organization in our minds make huge amounts of information accessible and memorable. And it's often precisely this organization – the connections between ideas – that we want students to know.

  Teachers can fail to take full advantage of the ways in which learners organize information in their minds. When writing assessments, multiple-choice questions and word banks can be very effective tools to discover if students can discern the correct answer among tempting alternatives. But this "recognition task" is far different from a "retrieval task" without a word bank, where students must supply an answer without the same cues. If your goal is for Gabriel to use synonyms for the word "nice" on his own, a multiple-choice vocabulary test would not serve your ultimate purpose, since it only lets you know if he can pick out an appropriate word from a list. You will exercise his pathway of associations most by creating

tests – and providing practice – that require him to search in long-term memory and generate synonyms without aid.

Circumstances will dictate how to build your students' cognitive filing systems. If Allyson is having difficulty spelling the word "invalidate," you might ask her to start by trying to find a word within it that she knows how to spell. Her web of associations may then locate the word "valid," and she will be on her way. Plus, by guiding her in this manner, you'll be helping her with strategies and cues for solving similar problems in the future.

- **Elaboration.** By pushing students to go beyond the information actually presented to them by analyzing or critiquing it, students are more likely to move that information into their long-term memory. You can help your students elaborate on the presented information by asking questions such as "Why do you think this happens?" "Can you think of some examples of this concept?" or "What can we conclude from this information?"

  Robert Sternberg, a Yale psychologist, recommends having students process (or "elaborate on") information in three ways: analytically, creatively, and practically. His "triarchic theory," therefore, is a method for ensuring that students engage with knowledge several times from several meaningful angles. Consider Sternberg's table of examples detailing this engagement of the concepts in the first column:

Concept	Analytical Processing	Creative Processing	Practical Processing
Tom Sawyer	Compare the personality of Huck to that of Tom	Write a very short story with Tom as a character	Describe how you could use Tom's power of persuasion
The formula for distance = rate x time	Solve a word problem using d=r(t)	Create your own word problem using d=r(t)	Show how to use d=r(t) to estimate driving time from one city to another
List of factors that led up to the U.S. Civil War	Compare/contrast the arguments of supporters and opponents of slavery	Write a page in the journal of a Confederate or Union soldier	Discuss the applicability of the lessons of the Civil War to countries today, like Yugoslavia
The main types of bacteria	Analyze the means that the immune system uses to fight bacterial infection	Name some ways to cope with the increasing immunity bacteria are showing to antibiotic drugs	Suggest three steps that one might take to reduce the chance of bacterial infection

But consider what your students are thinking about when they are learning the material. Daniel Willingham, a professor of cognitive psychology and neuroscience at the University of Virginia, warns that teachers ought to be very strategic when presenting material from a particular angle—because that is what students will remember.[6] If you have your students make a cake in the shape of Texas to reflect its geography, they will likely leave the activity remembering how they licked batter from the bowl far more readily than how the creation reproduced their state's natural features. Crafting activities that focus your students on what you want them to remember – such as having students find everyday objects that represent the natural resources of Texas's regions, and emphasizing the relationship between those resources and the products they yield – might focus the activity more.

[6] Willingham, Daniel. "Students Remember…What They Think About," *American Educator,* Summer 2003.

- **Explicitly teach these various memory strategies.** You should discuss with your students how they are remembering information. Discuss with them what we know about practice, organization, and elaboration. Encourage them to experiment with various strategies to see which ones are most effective for them.

Conclusion and Key Concepts

These three concepts—Bloom's Taxonomy, multiple intelligences and learning modalities, and memory theory—provide a solid foundation upon which to build your planning and instructional skills. You will find them useful as you formulate daily, unit, and year-long instructional plans, and we will return to them throughout the curriculum texts that you are reading in preparation for teaching. Having read this chapter, you should have a basic understanding of the following concepts:

- **Bloom's Taxonomy** is a six-level hierarchy that classifies levels of cognitive understanding. You should be able to describe, and provide examples of objectives that fall within, each of these six levels:
    - Knowledge
    - Comprehension
    - Application
    - Analysis
    - Synthesis
    - Evaluation

- Bloom's Taxonomy has many important implications for teachers. It illuminates the path to higher-order thinking, helps teachers logically sequence learning objectives, and provides insight into how to teach given objectives.

- **Multiple Intelligences** theory indicates that students may be "intelligent" in a number of different ways. Among the intelligences teachers should consider are linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, intrapersonal, and interpersonal.

- Similarly **Learning Modalities** theory describes the ways that individuals best learn new knowledge and skills. As a teacher, you must consider varying your instructional methods to meet the needs of visual learners, auditory learners, tactile learners, and kinesthetic learners.

- **Memory Theory** provides teachers with insights about how to best move students' knowledge from short-term to long-term memory. Among the key methods are varied and repeated rehearsal, accessing prior knowledge, strategically organizing new information, and elaborating on new information in ways that emphasize what you want students to remember.

In the next chapter, we will add a fourth component of learning theory to your toolbox—cognitive development. If the concepts in this chapter gave you a sense of how students understand, learn, and remember, the cognitive development theory will give you a sense of how students' understanding, learning, and memory develop and change as students grow older.

Cognitive Development

Chapter Two

I. Thematic Lessons from Cognitive Development
II. Grade-Specific Lessons from Cognitive Development
    A. Primary Grades
    B. Upper Elementary Grades
    C. Junior High School
    D. High School

In the last chapter, we considered a handful of learning theories that have direct implications for teachers dealing with a classroom full of students. We examined a model for evaluating the rigor of lesson objectives according to their cognitive demands. We explored the variations among students' learning modalities and intelligences, and we discussed strategies for ensuring lasting memory of what we are teaching.

Another idea from the field of learning theory that helps teachers purposefully design instruction is the concept of cognitive development. Cognitive development theory segments and categorizes the characteristics of students at different stages in their growth. Some familiarity with cognitive development is important to you as a teacher making instructional and management decisions.

In this chapter, primarily through a series of tables, we will provide an overview of children's cognitive, physical and social development. We will then focus on the implications of those generalizations for teachers in planning lessons and managing a classroom at various grade levels.

I. Thematic Lessons from Cognitive Development

Understanding cognitive development allows us to properly select curriculum and activities and to scaffold instruction so that students are challenged, but not frustrated.

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The core notion of cognitive development is that children develop skills and abilities in more or less predictable sequences. While not all children develop at the same rate, they do all pass through common phases of cognitive, physical, and social development. Although we will not explore here all of the many well-known theorists who have contributed to our understanding of this idea, we can boil down all of those theories to a series of thematic findings that are most relevant to teachers in the classroom. The following five themes (adapted from Jeanne Ormrod's *Educational Psychology: Developing Learners*) serve as founding tenets of cognitive development and provide important background for teachers:

(1) At different ages, children think in different ways. Cognitive psychologists study students' perceptions and analyses of the world around them. Generally speaking, children become increasingly capable of handling more complex and abstract ideas. For example, younger children may have difficulty interpreting figurative language. And, over the course of adolescence, students generally can handle more and more sophisticated problem solving. As teachers, we should encourage students to think about and describe the strategies they are using to access knowledge.

(2) Children actively construct meaning. Cognitive development theorists generally agree that children are not passive receivers of knowledge, but instead are active meaning-makers. That is, information does not simply seep into a child's brain; children are immediately processing new ideas—putting them into categories, making connections to other pieces of information they already know, and asking questions to develop an interpretation of the world around them. This theory of "constructivism" further states that students need first-hand experience, rather than simply a teacher's explanation, to abandon preconceived notions they have. As a result, rather than always being a "sage on the stage," an effective teacher should consider when it is appropriate to be a "guide on the side," crafting activities and open-ended questions that allow students to explore their world first-hand. On a cold day, younger students might believe their sweaters and hats produce heat; for some students, only through testing this notion with thermometers will the misconception be debunked. The act of watching students explore their own approaches for solving a problem—rather than simply telling them "the" way to do it, or letting them "discover" without any supervision or guidance whatsoever—gives a teacher insights into how the child thinks and how then to clarify any misunderstandings.

(3) A child's cognitive development builds on prior knowledge. Another theme running through all cognitive development theories is that very little, if any, knowledge is actually written on a "blank slate." New knowledge must be built on prior knowledge for students to achieve understanding. That is, no new idea can be explained for someone unless that person has some starting place for the explanation. As teachers, this concept reminds us to do all we can to build that prior knowledge. Again, we must expose our students to a vast array of experiences and ideas, as they will serve as foundations for more experiences and ideas.

Piaget's Framework for Cognitive Development
Swiss theorist Jean Piaget (1896-1980) is often credited with opening the door to studies of modern cognitive development. His multifaceted research in developmental psychology and genetic epistemology (the study of the formation and meaning of knowledge) was driven by his curiosity about how knowledge grows and develops in the human mind. His fundamental proposition that the growth of knowledge is a progressive pattern of increasingly sophisticated stages of mental faculty continues to serve as the backbone of cognitive development theory. To provide you with an overview of his highly influential theories, we have included two summary tables in the **Learning Theory Toolkit** (pp. 4-7: Piaget's Framework: Preoperational, Concrete Operational, and Formal Operational Thought); this Toolkit can be found online at the Resource Exchange on TFANet. 🛠

(4) Challenging student thought promotes cognitive development. While there are disagreements among theorists as to the relative influences of natural, internal development and externally-driven cognitive "exercise," cognitive development does tell us that pushing the rigor of students' cognitive experiences does affect students' general cognitive development. This idea encourages us as teachers to know our students' cognitive comfort zones and to teach just beyond those comfort zones. Easier said than done, since each child comes to the classroom with different prior knowledge and readiness levels. It becomes the educators' mission to structure lessons so that everyone is challenged. One way to do so is by scaffolding assignments so that all students receive the amount of assistance they need to complete a task.

(5) Social interactions enable cognitive growth. There is an entire branch of cognitive theory devoted to social learning. These scholars focus on the ways in which people learn through observation. By seeing someone model a task, succeed or fail during an attempt, and get rewarded or punished for a behavior, learners make decisions about what they will do—and how to do it. Teachers should then provide modeling in both academic and social situations. One effective strategy is "thinking aloud," where the teacher talks about his or her thought-processes when demonstrating a skill requiring decision-making. This allows students a window into the types of questions they should ask themselves when pursuing the same task. From the constructivist perspective, students should also have many opportunities to share

their ideas, perspectives, beliefs and thought-processes with peers and adults. Students who share and debate ideas will gain skills in seeing multiple perspectives and different ways of thinking, as well as help them discover flaws and gaps in their understanding.

II. Grade-Specific Lessons from Cognitive Development

Having outlined the most general lessons of cognitive development for teachers, we will now turn to specific insights that cognitive development has for teachers. We must begin with the obvious disclaimer that these lists of characteristics are merely generalizations. It is impossible to say with any certainty that *all* ten-year olds have any particular characteristic, other than being ten years old. A whole range of factors including developmental differences, environmental differences, and children's personalities can have a significant effect on whether a student meets the generic list of characteristics describing children of that age. A teacher should expect exceptions to the generalizations posed in this chapter:

> No matter how children are grouped chronologically or by grade, there will also always be a wide spread in normal developmental differences. A two-year span in development is normal in any area of a child's development—physical, social, language or cognitive growth. Thus, a child who is ten years old chronologically may still be exhibiting social behaviors more typical of a nine-year old. A five-year old may display the physical prowess of a six-year old. A seven-year old child may be reading at a fifth-grade level, but have trouble making friends like other seven-year olds.[7]

Thus, it is difficult if not impossible to say that there is some "average" or "normal" eight-year old. And yet, knowing what is "typical" is helpful to a teacher who is designing a classroom for academic achievement.

A. Primary Grades (Pre-K–3)

Children in the first several years of school are experiencing rapid conceptual and language development as they learn to read and write. In terms of their cognitive development, they tend to be literalists, still developing the ability to think abstractly. As a result, concrete ideas and objects are most appreciated and understood.

In terms of physical development, students in this age range show a wide variation in physical development, even within the same grade. They are rapidly refining gross motor skills and more slowly refining their fine motor skills. (In younger grades, girls are often ahead of boys in fine motor skills and language.) Children between the ages of 4-9 may have high amounts of energy (relative to most of the rest of us) and have difficulty concentrating on things that do not interest or make sense to them (again, even more than us, because they haven't developed self-regulation), which may translate into a short attention span.

[7] Wood, Chip. *Yardsticks: Children in the Classroom Ages 4-14*. Northeast Foundation for Children: 1997, p. 6.

Cognitive Development

Socially, these children are developing independence. They are also developing gender identity. Play, in its many forms, is highly significant for these younger children—a key to both socialization and cognitive exploration of new ideas and experiences. Generally speaking, much of children's social energy is focused on pleasing adults.

Of course, there are important changes going on in the minds of children from kindergarten to third grade. At some point, students develop the ability to see situations from others' perspectives, a task that is often difficult for kindergarten and first graders. Children also develop the ability to look beyond the "static" reasoning that they had when they were first entering school and reason about change and its effects. "Logic," in the sense that we all think of it, becomes more and more attainable during these primary school years.

So what are the implications of these patterns for teachers in those grades?

As an early childhood educator, I focus heavily on the social and emotional development of my students. It is my responsibility to explicitly teach my students proper school behavior and school readiness skills, such as how school works, how they should sit, walk, act, make friends, and so on. My classroom is my student's first experience with school and it is the basis on which all other years are built. It is a crucial year! My students are learning how to be friends, how to share, how express their feelings, and even how to dress themselves. It is my job to make sure that all of my students are ready for kindergarten, which encompasses much more than simply developing cognitive skills.

Claire Cohen, Southern Louisiana Corps '00
School Director
Philadelphia School District

I assumed "work quietly with your partner," was enough direction for 2nd grade students, after all they had already been in school for a few years. After weeks of frustration I connected their need for concrete instruction in academics to their need for concrete directions in my behavioral expectations. Once we broke it down to what "work quietly with your partner" looked and sounded like, we were able to get down to the real work of 2nd grade.

Ana Gutierrez, Houston '00
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Gateway Community Charters

Implications for Teachers of Primary Grades

Cognitive Development *The teacher should. . .*	**Physical Development** *The teacher should. . .*	**Socio-emotional Development** *The teacher should. . .*
• Use concrete examples • Make directions explicit and precise • Provide ample practice with language • Use lots of modeling • Attach language symbols to concrete experience • Plan lessons that are sensitive to activity levels and attention spans • Always have concrete referents for abstract concepts, including rules (abstract rules may have little meaning when Tommy discovers that Sharon has his toy) • Implant lots of language use in all activities • Provide opportunity for student interactions • Encourage student initiatives • Make use of songs, puppets, and art work	• Limit activities in which students compete on the basis of size and physical strength • Provide play areas and equipment for running, climbing, and jumping • Involve students in activities like coloring and cutting • Provide "cool down" time after playground activities • Be aware of helping students grip pencil correctly; focus on handwriting instruction	• Encourage and reinforce independence and initiative • Avoid sex role stereotyping • Provide opportunities for cooperative activities • Arrange lessons to ensure high degree of student success

B. Upper Elementary (Grades 3–6)

The transition to upper elementary school (which some might say occurs at third grade) is marked by the enhanced ability to perform logical operations with concrete materials, like math manipulatives. In the later elementary grades, children begin using abstract concepts more often and adeptly but still do so rarely (through rudimentary algebra, for example). Meanwhile, children's communication skills, both verbal and written, are rapidly improving. During the third, fourth, and fifth grade, teachers report that differences in cognitive styles (including learning disabilities) become more pronounced and recognizable.

Upper elementary students experience slow and steady physical growth and become increasingly concerned with physical looks, coinciding with their social inclinations to start looking to peers as the key locus of influence instead of adults. Sometime toward the end of intermediate grades, some students (more often girls at this age) experience "growth spurts" with the onset of puberty. Female students may begin to menstruate, a concept that some may not understand (or have heard of) until they actually experience it. Physical fitness is also a key issue at this age.

The social lives of upper elementary students are increasingly dominated by issues of status within groups (both socially and academically). And research tells us that students are developing a sense of academic self-worth that will usually stick with the child through later schooling.

Implications for Teachers of Upper Elementary Graders

Cognitive Development *The teacher should. . .*	**Physical Development** *The teacher should. . .*	**Socio-emotional Development** *The teacher should. . .*
• Provide a wide variety of concrete experiences for initial learning (for example—graphing, using objects to learn adjectives, etc.) • Involve students in activities that allow conversations about abstract concepts and operations • Continue to use concrete manipulatives where appropriate • Use technology to engage students in practicing classroom skills	• Promote appropriate eating habits and model and encourage fitness • Encourage and model physical activity and team athletics • Be aware of the social implications of appearance, offering reassurance to students feeling uncomfortable • Be sensitive to female students who need to use the bathroom during their menstrual period; male teachers may want to partner with a female teacher, who might keep feminine products in supply for unprepared students	• Create learning experiences that lead to success through work and effort • Allow students to demonstrate competence by assigning them classroom jobs • Send strong messages about the importance of drug-free living

C. Junior High School (Grades 7–9)

During the junior high years, students' cognitive skills are experiencing qualitative changes as they become fully able to think abstractly, systematically, hypothetically, and deductively. They are experiencing significant growth spurts and showing dramatic differences in physical maturation during puberty. Both female and male students will begin to smell differently and may not realize they need to start wearing deodorant, and you may need to relax your "no bathroom" policy for female students who are menstruating.

Cognitive Development

Seventh, eighth, and ninth graders are also experiencing deepening social relationships as they form, and experiment with, personal identity and preferences in dress and appearance. This new interest in appearance, fueled by physical changes, can lead students at this egocentric phase to think that all eyes in a room are on them—what psychologists call "the imaginary audience." Adolescents continue to look to peers as the key influence in their lives, and mutuality and loyalty of friendships increase. Students group themselves in same-sex friend groups, and some more intimate one-on-one relationships begin to form. Above all, students are concerned with "fitting in.

As a middle school science teacher, I found out quickly that my 7th grade students were just beginning to develop as social beings, and they definitely went through their "growing pains" in my classroom. I first chose to combat the talking through more rigidly structured lessons, but I soon realized that my daily instruction needed to contain just as much social instruction and practice as it contained science instruction and practice. I shifted my lessons to account for nearly 100% group work, I created a highly structured group environment with well-established roles, expectations, and procedures, and I allowed my students' energy for social development to be the engine of investment and achievement in my classroom.

Aaron Pomis, North Carolina '02
Founding Science Teacher
KIPP - Charlotte

Not coincidentally, this is also the stage in which students develop a generalized "self-concept." Adolescents begin to see themselves as having certain characteristics ("popular," "sporty," "different"), based on their previous performance and behavior, their position relative to others around them, and the ways in which they are treated by adults and peers. These definitions tend to fuel future behavior, so be conscious of how you are reinforcing a student's negative self-image. Communicate how much you like your students as human beings, even when you express disapproval of their choices. Deem poor behavior as "not like you," and seize opportunities to help children see themselves as capable and successful in school.

Males and females experience challenges during adolescence. National studies have indicated that the academic performance of female students begins to slip as these students enter adolescence, particularly in math and science; they may begin to internalize societal stereotypes about women and suppress their ability to express their point of view or assert themselves.[8] Male students are likely to have more self-confidence and higher career aspirations, but they are also less likely to graduate from high school.

Implications for Teachers of Junior High Students

Cognitive Development *The teacher should. . .*	**Physical Development** *The teacher should. . .*	**Socio-emotional Development** *The teacher should. . .*
• Provide extensive opportunities for abstract thinking, including consideration of moral dilemmas • Recognize that not all junior high students have fully developed abstract reasoning skills. • Recognize students may be inclined to challenge authority with their newfound skepticism of the world • Be aware and capitalize on students' fascination with the "gray areas" of life (for example—that American history is littered with morally questionable episodes)	• Minimize activities that draw attention to different levels of maturity • Promote appropriate eating habits and model and encourage fitness • Be sensitive to female menstruation (male teachers may want to partner with a female teacher, who might keep emergency feminine products in supply) and the potential for pregnancy	• Listen to and help students clarify their thinking as they go through the potential turmoil of identity formation • Create classroom systems to provide the security of structure while providing the freedom for personal expression • Create classroom activities that do not necessarily require students to "stick out" • Be particularly careful not to humiliate students or draw unwanted attention to them

[8] Rothenberg, Dianne. "Supporting Girls in Early Adolescence." ERIC Digest: ED386331. September 1995.

• Use technology as a way to engage students, stimulate self-expression, and formulate complex ideas		• Ensure that both female and male students have the opportunity to be heard during classroom discussions • Emphasize the risks of drug use and succumbing to peer pressure • Arrange for pen-pals or journal writing to foster expression

D. High School (Grades 10–12)

During the last few years of high school, students are generally demonstrating full, adult, abstract reasoning. Most students have reached full physical maturity as well (although some males may continue to grow taller). Students continue to focus on the importance of peer relationships, with male and female cliques interacting with each other, and students show an increasing interest in individual, intimate relationships. Adolescent peer groups during these years tend to be highly correlated with socio-economic status and plans for the future. Sadly, adolescence can be an emotional and psychological roller coaster for some, and psychiatric disorders, while rare, become more prominent (i.e., eating disorders, schizophrenia, depression).

Implications for Teachers of High School Students

Cognitive Development *The teacher should. . .*	**Physical Development** *The teacher should. . .*	**Socio-emotional Development** *The teacher should. . .*
• Without giving up more concrete instructional tools such as charts, illustrations, graphs, and diagrams, move students toward higher-order thinking whenever possible by encouraging them to explain how they solve problems • Create projects that enable students to experience the tasks and dilemmas of professionals in the disciplines your subject area represents	• Send messages about healthy body images • Learn to recognize and how to seek help for common adolescent health concerns • Be sensitive to female menstruation and the potential for pregnancy	• Be acutely aware of social pressures and anxieties among students • Actively encourage non-violent conflict resolution • Attempt to ease anxiety about the future by offering assistance about career choices and options for higher education • Recognize that students may be reluctant to risk their self-esteem and egos when asked to try a new skill in front of peers • Develop, support and enforce policies against gender-related harassment

[The website "Inside the Teenage Brain" provides a good overview of brain development in adolescents.[9]]

Positivity Knows No Bounds

While thinking about cognitive, physical and socio-emotional development can keep you attuned to the interests and needs of your specific students, it is possible to blind yourself to strategies that may be ageless and timeless, particularly when attempting to create a positive environment in your classroom. Sara Cotner taught third grade as a 2000 corps member in South Louisiana, and she now teaches sixth grade at the KIPP Academy in Houston. In her experience, developmental levels account for certain differences in approach, but certain rules are universal:

> *Of course there are noticeable differences between teaching third grade and sixth grade. Most of my 8 year-olds were thinking about Pokemon and riding their bikes, while most*

[9] http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/, accessed 7/10/2010.

of my 11 year-olds are thinking about the opposite sex and fighting with their parents. I have had to modify the themes of my units to tap into my students' interests and tailor my instruction to tap into my students' raised cognitive abilities. However, much of my approach has stayed the same.

First, I continue to use cooperative learning because people at all ages are fundamentally social. They need to learn (and they enjoy practicing) the skills of cooperation, collaboration, and conflict resolution. Further, they learn just as much (and sometimes more) from each other than they learn from me. We still have teams and team jobs (Leader, Parliamentarian, Liaison, Recorder, and Materials Manager).

Second, I continue to incorporate the element of competition into my classroom management and instruction. Students earn points for their class, for example, when they move about the classroom quickly and quietly (during unpacking/packing, transitions, etc.) Also, they compete in teams each day during our review of the "Do Now." The element of being part of a team increases their level of personal accountability, and it makes some of the more tedious tasks more fun.

Third, I still use positive reinforcement like there's no tomorrow. Students earn stickers on a sticker chart every time they score 100% on a vocabulary quiz. The stickers mean absolutely nothing, and yet the students still remind me expectantly when I forget to pass them out. Further, I still try to inundate my students with messages of achievement. When I stop teaching in order to apply a consequence, I always say, "Class, I am so sorry that we are wasting your learning time."

I still read aloud to them and always stop in the most suspenseful part so that they moan and groan and beg me to read more.

I still shake their hands as they enter my classroom each day and give them high-fives as they leave.

I still have call-and-responses to get their attention:

Teacher: If you read
Students: You'll succeed

Teacher: I like big
Students: Words and I cannot lie.

Teacher: Andele, Andele
Students: Mama, we like to read, oh, oh!

I still pass out raffle tickets when I want to reinforce positive behavior. I still have a word wall. The list goes on!

I think people are fundamentally the same at all ages: they like to be rewarded for what they do well; they like to be appreciated as an individual; they like to talk to their friends; they like to play games; they like to laugh; they like to learn new things. How to accomplish each of these things changes slightly depending on the age of students, but surprisingly not that much.

Conclusion and Key Concepts

Imagine for a moment that your regional placement changes at the last minute. All summer you thought you would be teaching first grade and now you will be teaching fifth. Or, imagine that you are trying to figure out how best to teach about "government" to second graders, or to seventh graders, or to eleventh graders. Your understanding of the developmental stages that children go through as their minds mature is very helpful in steering you toward an effective adjustment of your instructional methods to meet the minds of your students.

As discussed in the *Instructional Planning & Delivery* text, successful teachers do not choose instructional methods or grouping strategies in a vacuum. Instead, they carefully consider which choices will most help to reach our objectives with their particular students. Cognitive development's insights give us one more set of factors to consider as we are planning instruction and developing classroom management systems. Having read this chapter, you should have a basic background in the general themes of cognitive development.

- At different ages, children think in different ways.
- Children actively construct meaning.
- Cognitive development builds on prior knowledge.
- Challenging student thought promotes cognitive development.
- Healthy social interactions enable cognitive growth.

You also should have a basic understanding of the patterns we see in cognitive, physical, and social development in children of various ages. As we have discussed, those patterns will have implications for you as you purposefully plan lessons, develop rules, and lead your classroom to significant academic gains.

Learning Differences and Special Education

Chapter Three

I. Recognizing and Responding to Particular Learning Differences
II. Over-Arching Strategies for Addressing Learning Differences

Introduction

The subject of "learning theory" is ultimately about the similarities and differences in how individuals access, understand, store, and communicate information. In the early chapters of this text, we discussed various models for delineating different means of learning. We saw that some of us may have dramatically better memories with aural stimuli than visual stimuli. Some of us may learn most efficiently in kinesthetic learning scenarios while others require absolute stillness and quiet to really soak up new information.

Special Education Across the Curriculum
You will notice that special education-related issues are discussed in each of the various texts that you are reading in preparation for institute. A chapter in the *Instructional Planning & Delivery* text, for example, gives you an overview of the special education system itself—how students qualify and how they are served by the system.

At some point on the grand spectrum of learning differences, we begin to categorize and name recurring sets of characteristics of these differences. When those sets of characteristics impede learning in some way, we consider them "disabilities." This chapter attempts to provide you with an introduction to a small number of these "packages" of learning differences that we label as disabilities. By familiarizing yourself with these various learning differences, you will be more prepared both to recognize and to respond to the unique instructional needs that certain disabilities present.

This chapter will first focus on the various categories of disabilities that are described by the law that governs special education, the Individuals with Disabilities Education Act (IDEA), since those categories play such a key role in all schools' special education systems. Based on new teachers' most common challenges regarding students with disabilities, we will pay particular attention to three types of disabilities—specific learning disabilities, Attention Deficit and Attention Deficit/Hyperactivity Disorders, and emotional disturbances.[10] Then, the second half of this chapter will explore one particular protocol for supporting students with disabilities that has been developed by pediatrician Mel Levine called "Management by Profile."

I. Recognizing and Responding to Particular Learning Differences

In this section, we are going to focus on generalizations and patterns of differences that we see in students served by special education programs. First, we will survey the categories of disabilities that are delineated by IDEA. Then we will explore in more detail a handful of those categories that are most likely to apply to some of the students whom you serve.

[10] Department of Education website. "IDEA '97" homepage with links to various resources and information. http://www.ed.gov/offices/OSERS/Policy/IDEA/index.html, accessed 7/10/2010.

Categories of Disabilities Under IDEA

Although the many varieties of learning differences and disabilities defy definitive categorization, for the sake of administering special education services, IDEA roughly categorizes disabilities into thirteen categories. Children falling into one or more of these thirteen categories may be found to qualify for special education services if their disabilities affect their educational performance.

As stated previously, these categories are broad, and states (and even different regions within a state) sometimes use different terminology for these categories. You should of course become familiar with the categories your school district recognizes, but the terminology used here is very common among the states and will serve as a starting point for your learning. (The letters in parenthesis following each category are acronyms used by most states.)

By far the most common special education classification (making up 46.2% of the students receiving special education services) is **Specific Learning Disability (LD or SLD**).[11] This general term is used to describe a person who has a significant learning problem in one or more of the basic processes involved in understanding or using spoken or written language. Dyslexia is one example of a learning disability. These problems may manifest in a student's writing, math, spelling, listening, and/or speaking skills. Learning disabilities can also affect the way the brain processes information. (We will address learning disabilities more extensively below.)

Speech and Language Impairment (SI or SLI) is the next largest group, making up almost one-fifth of the students in the special education system. This category includes various communication disorders, such as stuttering, impaired articulation, language impairments, and voice impairments.

Approximately one in ten students in special education has an **Intellectual Disability (ID)[12]**, indicating that they demonstrate sub-average general intellectual functioning that exists concurrently with deficits in adaptive behavior (such as limitations in self-care, home-living, health and safety, and the use of community facilities). An intellectual disability can range from mild (IQ between 55 and 70) to a level of severity that inhibits basic physical and mental functioning.

Serious Emotional Disturbance (ED or SED) is a category that represents about eight percent of students in special education and includes students who display long-recurring behaviors (in more than one context) that seriously interfere with the learning environment and their ability to perform in and benefit from it. The category **Other Health Impairments (OHI)** includes Attention-Deficit/Hyperactivity Disorder and comprises about three percent of the students in the system.

Other categories are **Orthopedic Impairment (OI),** which includes physical impairments caused by congenital anomalies as well as physical impairments caused by disease or accidents, and **Traumatic Brain Injury (TBI),** which includes students who have suffered traumatic brain injury. Children with TBI may have difficulties with some combination of cognitive, social, and physical functions.

Autism (AU), a neurological disorder that interferes with development of reasoning, social interaction and communication, is its own category. Students with autism have substantial problems communicating; approximately half are nonverbal. Others have a limited ability to understand or express abstract ideas.

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[11] U.S. Department of Education, Office of Special Education and Rehabilitative Services. "Annual Report to Congress on the Implementation of IDEA."

[12] The term intellectual disability (ID) is fairly new. Some states may use the term mental retardation (MR) instead of intellectual disability (ID). In these texts we will use the term intellectual disability in order to align our terminology with the Federal government and other organizations, including the National Dissemination Center for Children with Disabilities (http://www.nichcy.org/Disabilities/Specific/Pages/IntellectualDisability.aspx).

Deafness, Deaf-blindness (DB), Hearing impairment (AI or HI), and Visual impairment including blindness (VI) are four more categories under IDEA. A final category **Multiple disabilities (MD),** covers children with more than one impairment, the combination of which causes such severe educational problems that the student cannot be accommodated in a special education program solely for one of the impairments.

Today, approximately 13% of the school age population fits at least one of these categories and therefore qualifies for services under IDEA. That percentage is up from 8.3% of the student population in 1976-77. A host of factors—including changing definitions of various disabilities and a dramatic growth in the number of children identified under the "specific learning disability" category—has contributed to the rapid growth in numbers of students receiving special education services.

The thirteen categories notwithstanding, who does and does not qualify for special education services is a profoundly complex question. From the start, vagueness of the disability definitions makes for considerable differences from state to state and school to school in who qualifies under a particular category.

> Although IDEA and implementing regulations specify thirteen categories of disabilities, criteria for defining these categories are not clear-cut, and many states and school districts use modified taxonomies. There are particular problems in distinguishing students with mild cognitive disabilities, such as mild intellectual and learning disabilities, from some students who are low-achieving. Indeed, identification and classification practices vary so greatly that a student who is identified in one of these categories in one school district may not be so identified in another, and the overall reported prevalence of disability varies across states from approximately 7 to 15 percent of the school-age population.[13]

Having sketched out all thirteen categories of disability under IDEA, we will now turn to a more in-depth look at several forms of disability that all teachers, both in general and special education, are likely to work with: learning disabilities, Attention-Deficit/Hyperactivity Disorder (AD/HD), and emotional disturbances.

The Vast Realm of "Specific Learning Disabilities" under IDEA

Defining "learning disability" has been difficult. According to the Coordinated Campaign for Learning Disabilities, a group of the six leading national LD organizations, the term "learning disability" describes "a neurobiological disorder in

Spotting Learning Disabilities

Ultimately, the diagnosis of a learning disability will fall to a doctor or other professional. Classroom teachers, however, are often in the best position to see signs that special services may be needed. If you do suspect that a student may have a learning disability, you should gather information and discuss concerns with a school administrator. You, and others who are in regular contact with the child, should gather information about the student's academic performance and learning needs. This should include areas of strength and weakness (both in school and in other settings) and any accommodations that have proven useful to promote success in learning. If a student's difficulties do not improve, the student's parents or guardians should arrange a comprehensive educational evaluation. These evaluations can only take place with the written consent of a parent or guardian. Evaluations are meant to help identify areas of relative strength and difficulty, and to help determine whether the student is eligible for specialized assistance in school. When parents and school personnel agree that an evaluation is warranted, the public school system must provide an evaluation to determine if a student is entitled to special education services.

[13] Committee on Goals 2000 and the Inclusion of Students with Disabilities. "Educating One and All: Students with Disabilities and Standards-Based Reform." National Academy Press: 1997, p. 10 of 15.

which a person's brain works or is structured differently. These differences interfere with a person's ability to think and remember. Learning disabilities can affect a person's ability to speak, listen, read, write, spell, reason, recall, organize information, and do mathematics."[14]

Prior to the 2004 reauthorization of IDEA, experts primarily used two key concepts to identify students with learning disabilities—an "ability-achievement discrepancy" and a "definition of exclusion." First, experts noted that individuals with learning disabilities had "average" intellectual ability, but their academic performance fell below that potential. Different states defined and identified this discrepancy differently, but in all cases this discrepancy between potential and performance was key to meeting the criteria of having a "learning disability." Second, most professionals used a "definition of exclusion" when defining an LD population. That is, the child with a learning disability was defined as a child one who was not functioning in school despite the fact that the child was (a) not intellectually disabled, (b) not emotionally disturbed, (c) not impaired in his modalities (e.g., blind, deaf), and (d) had an opportunity to learn not hindered by lack of instruction in his or her native language, excessive absences, poor teaching, frequent family moves, etc. The definition thereby "excluded" other potential causes.

However, some LD experts believe that these two LD identification criteria—the "ability-achievement discrepancy" and the "definition of exclusion"—are problematic for students. Under this identification system, students essentially have to fall far behind (or "fail") *before* they are eligible for special education or other intervention services. As intervention specialist Natalie Rathvon explains:

> When the Education for All Handicapped Children Act (Public Law 94-142) took effect in 1975, it did not mandate a specific approach for states and local school districts to use in identifying and classifying students as learning disabled (LD). Moreover, at that early point in research on learning disabilities, there was no consensus on the specific cognitive and linguistic markers for learning disabilities. By default, diagnosis became an *exclusionary process*—that is, IQ tests were administered to rule out the possibility that a child's academic problems resulted from low intelligence, based on the assumption that the problems of children with average intelligence differed from those of children with low intelligence, arose from a different set of cognitive deficits, required different interventions and had a different (i.e., better) prognosis (Torgesen, 2000). The necessity of demonstrating a severe discrepancy between cognitive ability and achievement meant that help was delayed until the student's achievement level was low enough to meet the criterion. As a result, most students were not formally identified as learning disabled until third grade or later, well after the time when assistance could have been most effective (Torgesen et al., 2001). Given this "wait and fail" model, it was not surprising that many students made minimal academic gains after placement and that few were able to exit special education programming (Donovan & Cross, 2002; Lyon et al., 2001).[15]

In an attempt to prevent these problems, the 2004 reauthorization of IDEA began to outline new ways for local education agencies (LEAs) to identify students with learning disabilities. Most learning disability experts now believe that achievement-ability discrepancy models should be abandoned in favor of models that track students' *response* to academic interventions. Natalie Rathvon explains:

> Although the term is not specifically used in IDEA 2004, this process is referred to as *response to intervention* (RTI)...In contrast to the 'wait and fail' model of identification and service delivery, RTI is a proactive approach to identify students with academic and/or behavioral difficulties *as*

[14] http://www.focusonlearning.org/, accessed 7/10/2010.

[15] Rathvon, Natalie. *Effective School Interventions: Evidence-Based Strategies for Improving Student Outcomes, 2nd edition.* New York, NY: The Guilford Press, 2008, pp. 5-6.

soon as they begin to struggle (Barnett, Daly, Jones, & Lentz, 2004; Yell, Shriner & Katsiyannis, 2006). In RTI models, students receive evidence-based instructional practices and interventions, with the level of service matched to their level of need and frequent monitoring to determine response. Progress monitoring results are used to make decisions about the need for additional interventions or levels and types of services in general and/or special education."[16]

Because not all LEAs have adopted the RTI identification model, today students may receive learning disability labels based on the severe-discrepancy model of identification **or** they may receive an LD label based on a response-to-intervention (RTI) model. That said, most researchers now believe students should be classified as learning disabled based on the following criteria:

1. Inadequate response to appropriate instruction (the RTI model).
2. Poor achievement in reading, mathematics, and/or written expression.
3. Exclusionary considerations: Evidence that other factors (e.g., sensory disorders, intellectual disabilities, limited proficiency in the language of instruction, inadequate instruction) are not the primary cause of low achievement.

Instructional and Behavioral Strategies for Students with Learning Disabilities

The wide range of characteristics of various "learning disabilities" also makes generalizations about appropriate instructional strategies extremely difficult. You and the other professionals at your school will be charged with making the right judgment about which of these accommodations is most appropriate given a particular student's needs. Formal meetings, such as the creation or revision of a student's Individualized Education Program (IEP), are the official occasions in which teachers, parents and diagnosticians identify these techniques.

If a student has documented memory difficulty, that student might be allowed to use notes during a test. For students with metacognitive difficulty, who have trouble monitoring their own progress during learning, you can provide graphic organizers, strict outline formats, and regimented note-taking strategies to help your students to manage incoming information more effectively. For students with a perceptual difficulty, such as remembering the correct order of letters in a word, we might use a variety of modalities – writing the word for the student, saying its letters aloud, having the student trace the letters – to communicate the information. The accommodation should fit the learning difference.

Some forms of learning disabilities are circumvented effectively through technology, so you may consider computer-use as a possible instructional strategy. And, as general principles of differentiation would tell us, you may have the most success with students with learning disabilities if you offer several options for academic practice and evaluation.

Above all, remember that teaching students with disabilities simply requires excellent teaching—the same excellent teaching that you would be providing all of your students. Differentiating instruction, being diplomatic regarding mistakes, frequently discussing student progress, being very clear with instructions, minimizing distractions in and around the classroom—all are instructional strategies that are often suggested for students with learning disabilities that should be fundamental aspects of your teaching of all students.

Similarly, behavioral strategies for students with learning disabilities will ring familiar as strategies that are important for all students. To lead students with learning disabilities to academic achievement, you should provide praise clearly and often, be consistent in enforcing your clearly stated expectations,

[16] Ibid, pp. 6-7.

establish a calm, structured classroom through classroom systems, communicate regularly with students' families, and be sure a student knows the reasons for any disciplinary actions you must take.

Attention Deficit/Hyperactivity Disorder (AD/HD)

A condition that you have probably heard a lot about in the last decade, and yet you will not see expressly listed in IDEA's list of special education categories, is attention deficit/hyperactivity disorder (AD/HD). However, in 1991, the U.S. Department of Education issued a "policy clarification" indicating that children diagnosed with AD/HD may be eligible for special education services under the "other health impaired" (OHI) category of IDEA. This decision alone greatly increased the number of students in the special education system.

General Characteristics

Once considered distinct from ADD (attention deficit disorder), AD/HD is now the overarching term used by the American Psychiatric Association and is divided into three subtypes, based on the main features linked to the disorder: predominately inattentive, predominately hyperactive and impulsive, and combined. Students with inattentive tendencies often have trouble listening, following directions and maintaining focus. Students who are hyperactive may fidget or want to move around the classroom, have trouble staying quiet, and appear to have a surplus of energy. Students who are impulsive tend to have difficulty waiting their turn, may blurt out answers, begin assignments before receiving or reading instructions, and fail to consider the consequences of risky or destructive behavior. Some students with AD/HD may also exhibit poor school achievement, exceptional imagination or creativity, noncompliance or defiance, and difficulty interpreting social situations or establishing friendships; they are also at a greater risk for dropping out than their peers.[17]

To meet the official definition (according to the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition), a student must demonstrate six out of the nine symptoms for a particular subtype in order to be diagnosed with the disorder. In addition, hyperactive-impulsive or inattentive symptoms that cause impairment must have been present before age seven. Some impairment from these symptoms must manifest in at least two settings (e.g., at home and at school or work). Finally, there must be clear evidence of interference with developmentally appropriate social, academic, or occupational functioning.

Really Active or AD/HD?

All children have difficulty paying attention, following directions or being quiet from time to time. If a child exhibits this type of activity, it does not necessarily mean that child has AD/HD. To be considered for a diagnosis of AD/HD, a child must display these behaviors before age 7 and the behaviors must last for at least 6 months. The behaviors must also be negatively affecting at least two areas of a child's life (such as school, home, daycare settings, or friendships) for a child to be diagnosed with AD/HD. For more technical information about the diagnosis and evaluation of children with AD/HD, please see the following report by the American Academy of Pediatrics:
http://aappolicy.aappublications.org/cgi/content/full/pediatrics;105/5/1158

Instructional and Behavioral Strategies

As described earlier, it is important for teachers to match the strategies they use with the student's learning difference. You might permit a student with hyperactive tendencies who may need a quick break during a long test to take a walk down the hall and back. To avoid getting distracted, a student with attention deficiencies may need to keep his or her desk clear of materials except those that are necessary for the task at hand. An IEP might mandate breaking a student's assignments into more obviously manageable pieces, whether by limiting the amount of material on a handout, or by splitting homework assignments into several mini-assignments.

[17] Barkley, R.A. *Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment* (2nd ed.). New York: Guilford Press, 1998.

In this way, the student is developing a repertoire of mechanisms to manage his or her disorder while continuing to meet the standard expectations for all students.

In general, you may notice that, as with the instructional strategies for students with learning disabilities, many of the adjustments you can use simply amount to good teaching. That begins with giving concise and clear directions. You should use "alerting" messages such as "Everyone Listen," or saying a student's name before asking a question. In some cases, it may be helpful to create a prearranged signal to regain the child's attention when the student loses focus. Many teachers find that using a timer to measure and encourage longer and longer periods of focused attention reaps instructional benefits. You may also find it helpful to use eye contact and proximity to help a student with AD/HD get started on an assignment. You can minimize visual and auditory distractions by sitting the student close to the front of the room and the teacher (but not near the door or other distractions). Students with AD/HD can also respond positively to predictable schedules and routines. Again, the particular strategies that you would use depend on the subtype of AD/HD under which your student had been diagnosed.

Behavioral management can, in some cases, pose challenges for students with AD/HD. Again, however, few of the common suggestions are very different from the way you should manage your classroom for the benefit of all students.

Students with AD/HD perform best in a classroom environment with diverse instructional approaches that encourage attention and participation (e.g., hands on activities, cooperative learning, direct instruction methods). Rules must be clearly defined and consistently enforced and, especially with younger children, you should give concrete examples of expected behavior.

You should be prepared to recycle behavioral interventions, as students with AD/HD in particular tend to "burn out" quickly on individual behavioral strategies. Moreover, many teachers find that routinely asking the student him or herself to evaluate whether he or she is paying attention is an effective behavioral and instructional strategy.

Finally, you should be in regular contact with the parents or guardians of students with AD/HD. Because caretakers may change what happens at home to address the disorder – such as making adjustments to medicinal dosages – it will be valuable for you to know and share information about what may be affecting your student's progress or behavioral changes.

Students with Emotional Disturbances (ED)

Students identified with emotional disturbances pose a particular challenge for teachers, as the adjustments that teachers must make often involve behavioral management rather than instructional methods. Students with ED have serious challenges in controlling themselves and require a great deal of patience, structure, and reinforcement. Just as in the LD population, students with ED tend to have average to above average cognitive ability, but their performance lags due to interference from social and emotional conflict. (Note that some states identify "behavioral disabilities" (BD) instead of ED. Others use both labels.)

General Characteristics

No specific characteristics describe all students with emotional disturbances. We can, however, provide examples of the kinds of behaviors that might be displayed by this population of students. Students may exhibit attention-getting behaviors, low self-esteem, and poor impulse control. They may show defiance of authority figures and have poor social interaction skills with peers or adults. In most cases, such behaviors negatively impact their or others' learning and must be addressed in the classroom.

Instructional and Behavioral Strategies for Students with Emotional Disturbances

The most effective strategies for students with emotional disturbances are focused on helping students recognize and manage their own reactions to frustration. In terms of instruction, it may be helpful to set precise, short-term expectations for student work and to ensure that instructional material is challenging but within reach. Students may also benefit from mini-breaks between lessons and frequent repetition of clear instructions.

Some students with emotional disturbances need particular help managing their own behavior. To that end, you should use positive reinforcement and behavior contracts when appropriate. To the extent possible, you should resolve conflicts privately with the students as opposed to publicly in front of other students, and always address the specific behavior that is inappropriate and avoid any indication you dislike the student personally. Be sure to label the exact behavior desired; do not be subtle. Also, think creatively about ways to allow students to "escape" their own behavior, providing students a "way out." This is often best accomplished by giving students a choice and clearly describing the consequences of each choice.

Teaching students with emotional disturbances, like teaching all students, requires patience, consistency, and planning. Perhaps most important of all, it requires a teacher's refusal to lower expectations for the students, both for academic achievement and behavior.

> Effective treatment of [emotional disturbances] involves making these individuals strictly accountable for their behavior, insisting on compliance with requests and helping them learn to cope calmly with stressful situations. Unfortunately, once these students are identified as in need of special education, many of the accommodations routinely provided them—and most especially a lowered standard of acceptable behavior—actually work to undermine these desirable goals.[18]

Other Categories of Disabilities

We have discussed here only three of the many categories of disability that you will likely encounter in your classroom—learning disabilities, ADD and AD/HD, and emotional disturbances. These areas were highlighted because new teachers often find differentiating instruction for students in these groups particularly challenging. Do not overlook, however, the many other disability categories and the instructional strategies that can be employed to individualize instruction for them. As you have read in this section, these differentiated strategies may be helpful for all of your students, not just students with disabilities. For additional resources for teachers of students with disabilities, see page 8 of the **Learning Theory Toolkit**, which can be found online at the Resource Exchange on TFANet. 🛠

II. Over-Arching Strategies for Addressing Learning Differences

By their very nature, disabilities defy broad, one-size-fits-all instructional approaches. As you have seen from the instructional and behavioral management suggestions above, there is no universal strategy in special education, even for students who qualify for services under the same definition.

There are, however, general principles of approach that offer teachers an overarching framework for interacting with a student with a disability. Dr. Mel Levine, a well-known developmental-behavioral pediatrician and Professor of Pediatrics at the University of North Carolina Medical School, has developed

[18] Horn, Wade and Douglas Tynan. "Time to Make Special Education 'Special' Again." In *Rethinking Special Education for a New Century*, edited by Finn, Chester et al. Fordham Foundation: May 2001, p. 43-44.

one such set of principles that many new teachers find helpful in learning to address students' special needs. Although Dr. Levine's approach, which is outlined in his book *All Kinds of Minds*, was developed for learning disabilities, the general principles espoused by this "Management by Profile" approach can be applied to other areas of disability as well.

At the centerpiece of this method are five guidelines for interacting with students with disabilities. They are:

(1) Demystification
(2) Accommodations
(3) Interventions at the Breakdown Points
(4) Strengthening of Strengths
(5) Protection from Humiliation

Demystification

"Demystification" refers to a teacher's responsibility to give a student with a disability an opportunity to discuss his or her disability openly and honestly. Partnering with professionals at your school who will have more specific information for a child about his or her disability, teachers can begin this conversation by assuring the student that all students learn in different ways and all students have strengths and weaknesses. The teacher can then talk, and encourage the student to talk, openly about his or her strengths and weaknesses and a plan for taking advantage of those strengths and shoring up the weaknesses.

Most experts stress that this demystification stage needs to be more than a mere label. Students need to understand to the extent possible the physiological, psychological, or emotional factors at play in their disabilities. Dr. Levine explains:

> To tell a child he has LD or something like that—to give him a mere label—in no way empowers him to do something about it. But to talk to a kid about his active working memory and short-term memory deficiencies as well as his strengths, really allows him to feel that his problems have some borders around them, that he has some assets, that he can invest in helping himself. It makes him feel more optimistic, more in control, and it can have the same effect on his parents.[19]

Of course, the demystification process must be made in an age appropriate way. Younger children may not understand the details of their own disability. They can, however, understand that all students have some strengths and some weaknesses, and that their weaknesses mean that they have a difficult time remembering words, or drawing numbers, or hearing sounds.

By giving students a vocabulary for their own strengths and weaknesses, you are not undermining their accountability for academic achievement. In fact, a teacher must work to preserve that sense of accountability: "You have a weakness in X, so you have to work harder and differently to succeed in X." Without emphasizing the persistence and extra effort that you expect your students to exert, simply acknowledging a disability can provide an excuse for poor performance.

[19] Levine, Melvin. *All Kinds of Minds: A Young Student's Book About Learning Abilities and Learning Disorders*. Educators Publishing Service: June 1992.

Accommodations

The second general principle requires a focus on accommodations or "bypass strategies" that are used to circumvent the child's weaknesses so that the child can continue to learn. At several points in these training texts, we describe various accommodations that teachers may make to individualize their instruction, including adjustments to the time, volume, and format of assignments. (See chapter eight of *Instructional Planning & Delivery*.)

According to Dr. Levine, the best results occur when the students are well aware of the accommodations, and understand the relationship between the specific accommodation and the students' special needs. A child who is given extra time for a multiplication assignment should be able to explain, for example, that one of her weaknesses is processing numbers quickly and that the extra time allows her the chance to double-check her work. Or a child with attention deficiencies might be given fewer problems to complete during class, but knew that he or she would be expected to finish the rest at home—in a strategy Levine calls "accommodations with payback." "Payback" emphasizes that accommodation is not a free ride and should not be seen as removal of the students' responsibility.

Interventions at the Breakdown Points

Part of any approach to teaching children with special needs must include a recognition of the "breakdown points"—the moments when the child's disability is in fact interfering with learning. Experts, including Dr. Levine, recommend that teachers learn to recognize those moments through careful observation and task analysis of students' work. At those moments, the teacher "intervenes" by providing additional support or knowledge, providing additional structure, or showing students new strategies to use in those difficult moments.

Such an intervention might be something as simple as a hand signal you have worked out with one of your students with emotional disturbances that tells the student to stand up take a deep breath and walk to the back of the class. When you see the tell-tale signs of trouble, you give the hand signal to refocus the student's attention on control and to alleviate the pressure on the student. Or, such an intervention might take the form of teaching a student with dyslexia a regimented protocol when she encounters a word that she can't read. Perhaps step three or four of that protocol is to ask you for assistance.

Strengthening of Strengths

Another key principle in Dr. Levine's approach is that a teacher should discover, recognize, and exploit students' strengths. Perhaps a child with a learning disability is also a fantastic artist. The teacher should provide explicit recognition and reinforcement for that skill. Moreover, the teacher should develop roles in the classroom for the child to showcase his or her assets.

It is no coincidence that often the students with the most challenging behaviors are also the students who have the hardest time reading. Can we really blame them? At some point during my first year teaching, I realized, "They have been told endless times to sit down and look at one of these 'book things' with letters, words, funny dots, and crooked lines for the past six years. They have been told to read it, understand it, talk about it, draw pictures of it, read it aloud in front of others, and then write about it (another challenging task)! Books have been the source of so much stress and equated with so much failure in their lives. No wonder there is a virtual riot every day during reading. It is just plain hard to have reading difficulties." After this realization I began really focusing on improving their confidence and self-esteem about their reading capabilities. I set up a "reading partner afternoons" twice a week for my students to read to first graders. Having the ability to help younger students really helped them to see that reading could be an incredible source of pride. This in turn helped our mornings of reading class to be much more manageable.

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Protection from Humiliation
The final principle of this model, and one that should certainly apply to all teachers for all students, is the idea that a teacher must create an atmosphere for students with special needs that is free of teasing or humiliation. All students must feel safe from ridicule in order to take the risks necessary to master new ideas. Teachers should begin creating this atmosphere proactively, before the problem has arisen, by setting norms of interaction in the class that respect input and learning-driven risk-taking. That way, if you choose a classroom activity (such as peer-editing) that reveals a particular student's differences (such as poor handwriting as a result of fine motor deficiencies), your class will be more likely to understand and empathize with that peer's unique needs and challenges. You should also expressly appreciate anytime a student takes a public risk for the sake of learning. Finally, you should be aware of any routine classroom activities that may incidentally expose students with special needs to ridicule.

Taken together, these general principles—demystification, accommodations, interventions at the breakdown points, strengthening of strengths, and protection from humiliation—combine to form a helpful approach for empowering students with special needs to take command of their own learning and achievement in the classroom. Rather than developing excuses about why a student cannot reach the same level as his or her peers, your approach will emphasize that the right strategies, combined with persistence, will enable students reach heights they might have otherwise assumed impossible.

Conclusion and Key Concepts

While all students come to school with different strengths, areas of background knowledge and cultural conventions, you will likely be responsible for the academic success of students whose learning differences interfere with their academic progress to such an extent that we have categorized their condition as a "disability." This chapter has attempted to provide you with an introduction to those categories and with a menu of instructional delivery and behavioral management strategies to address students' needs. After reading this chapter, you should be familiar with the following concepts and ideas:

- The Individuals with Disabilities Education Act (IDEA) delineates thirteen categories of disability.

- The "learning disabilities" category includes almost half of the students in the special education system. Those students represent a wide range of learning differences that manifest in a difference between potential and performance. You should be able to describe some examples of instructional strategies for students with particular learning disabilities.

- Attention Deficit Disorder (ADD) and Attention Deficit/Hyperactivity Disorder (AD/HD) are conditions that may qualify a student for special services under IDEA. You should be familiar with a number of instructional and behavioral strategies for best serving a student with ADD or AD/HD.

- Students with emotional disturbances often possess average to above average cognitive ability but their performance lags behind their potential due to emotional turmoil. Most effective instructional and behavioral strategies for students with emotional disturbances are aimed at helping students manage reaction to frustration.

You should also be familiar with a general, overarching approach to teaching students with disabilities that includes:

- Demystification
- Accommodations

- Interventions at the Breakdown Points
- Strengthening of Strengths
- Protection from Humiliation

Of course, in the process of exploring these instructional and behavioral strategies, we hope that you have recognized the applicability of these strategies to all students, not only those who have qualified for special education services. You will discover that the individual prescriptions for instructional management suggested in this chapter are in some sense models for the individual approach that will develop, formally and informally, with every student in your classroom.

Teaching for Understanding:
"Getting Into Your Students' Minds"

Chapter Four

I. Informing Instruction with Your Students' Perspectives
   A. Breaking Down Concepts...
   B. And Putting Them Back Together Again
   C. Building on Students' Prior Knowledge
   D. Learn about Students' Cultural and Experiential Reference Points
   E. Recognizing and Overcoming Students' Misperceptions
   F. Considering Student Motivations

Consider the following problematic snippets of various lessons:

> **Second Grade—Plant Growth**
> *A second-grade teacher, charged with teaching the key factors in healthy plant growth, leads a kinesthetic exercise in which some students pretend to be plants growing and blooming while other students pretend to be the sun and rain and soil. The teacher then gives each student a bean, some dirt, and a cup, and they plant their seeds and put the cups in the window. For closing, the teacher has the students predict what will happen to the bean, and all of the students predict that it will grow into a plant.*
>
> **Ninth Grade—Models of the Atom**
> *The objective in a ninth grade physics class is: "The student will be able to describe the evolution of our understanding of the atom." The teacher gives an engaging lecture with visual aids explaining Dalton, Rutherford, and Bohr's models of the atom. On the teachers' "exit slips" (daily closure quizzes that he uses to check for understanding), when asked to summarize the evolution of our understanding of the atom, all of the students simply drew the three models.*
>
> **Fifth Grade—How Planes Fly**
> *A fifth grade student asks her teacher, "How do planes fly?" The teacher, pleased that the student is asking such great questions, explains, "The shape of the wing, with the curved top side, forces air molecules more quickly across the top of the wing than the bottom. This leads to lower pressure on top of the wing, in essence creating a vacuum so that the plane is pulled upward. That's a great question!"*

• • •

Although each of these scenarios contains some elements of good teaching, in each case the instruction is fundamentally flawed because the students did not learn what they were supposed to learn.

What happened? Why were these "lessons" unsuccessful? These faulty lessons represent a closely-related series of problems that sometimes undermine new teachers' effectiveness.

- In the first scenario, the teacher shows students a concept (plant growth) *without explicitly breaking that concept down into its component parts to show cause and effect*. While the students may leave knowing that plants do in fact grow, there's no indication that the

objective was actually met; the students are unlikely to be able to tell what components cause plant growth.

- In the second scenario, the teacher successfully broke down (atomized?) the concept being taught by discussing the three different models of the atom, but the teacher *taught those models in isolation, without any explanation that there was progress being made as these models evolved over time.* Thus, the students seem to leave able to describe the pieces of the concept, but with no true sense of the over-arching concept demanded by the objective.
- In the third scenario, the teacher provides a perfectly good explanation for some audiences, but not for a fifth grader. The teacher *fails to consider that her audience may lack prerequisite knowledge to understand that explanation*. The student may not understand concepts she used in the explanation, like "low pressure" and vacuum.

All three of these teachers have demonstrated a lack of forethought and insight about how students would receive and process the new information. The second-grade teacher failed to "get into the mind" of the students enough to realize that the information being received in their mind did not match up with the actual demands of the objective. A better teacher would have recognized during the planning of this lesson that this approach would not produce in students' minds a list of factors that help plants grow. Similarly, the ninth-grade teacher failed to "get into the students' minds" sufficiently to realize that they were only receiving a static view of three different concepts without any sense of the longitudinal relationships among those concepts (as required by the objective). Finally, the fifth-grade teacher seems oblivious to the students' starting reference points for the explanation about how planes fly. A more thoughtful teacher would realize that success in this explanation will depend on hooking it, perhaps by analogy, to something the students already understand. (See the Conclusion of this chapter for how a teacher might attempt that difficult challenge.)

These poor examples of teaching are meant to emphasize the deceptively simple idea that the lesson plan structure is not implemented in a vacuum. While a lesson plan template gives you a proven process on which to hang your instructional decisions, it does not answer the very difficult judgment questions that govern what content you impose on that structure. All three of the teachers above might give the same explanations in a perfectly complete lesson plan format, but the students still would not be "getting" the concept in a way that meets the lesson objective.

Excellent teachers think long and hard about their approach to an objective *before* mapping out a lesson plan. Successful teachers—like successful leaders, writers, lawyers, doctors, performers, and counselors—think carefully about their *audience*, asking themselves how to most effectively match up the desired objective with the particular minds that will receive the instruction. Clearly, the same objective might be taught quite differently for two groups of students who have different ages, interests, experiences, and prior knowledge.

In some ways, this chapter is an extension of the "purposefulness" mantra that permeates the *Teaching As Leadership* and the *Instructional Planning & Delivery* texts. We do not randomly select our instructional methods, but rather, we make purposeful choices about methods based on the needs and strengths of our students. In this chapter, we will highlight some of the lessons that learning theory has for a teacher who is trying to "get in the mind" of his or her students in order to inform those instructional choices.

I. Informing Instruction with Your Students' Perspectives

While recognizing the type or types of explanations that you may be giving in a lesson helps you choose instructional strategies, thinking carefully about how those explanations will be *heard* and *received* by your students may be the single most important factor in assuring that your students truly master your objective. Again, the key to students' understanding of your lesson is your understanding of your students—their perspectives, prior knowledge, interests, misconceptions, and thought processes. In a very real sense, this entire text is built on that premise. We must know *how* and *what* our students think in order to most effectively design a lesson that is going to lead them to true mastery of our objectives.

Unfortunately, too many new teachers fail to think about their lessons from a student's perspective—to experience lessons as students would experience them and then consider whether that experience actually comports with the lesson objective. They provide explanations that, for a whole host of reasons, are simply not accessible to students. We saw, for instance, three examples of explanations that missed their marks in the introduction. In each situation (except, perhaps, the third example about how airplanes fly), the students were learning something, but they were not receiving from the lesson what the teacher intended them to receive. If the teacher had been thinking critically about what the students were actually taking away from the lesson, the teacher would have realized that the objective was missed.

Other examples are readily available. Perhaps your explanation of plate tectonics assumes prior geographical knowledge that a classroom of eighth graders simply does not have. Perhaps your explanation of how to outline a persuasive argument presents too many parts too quickly for your second-grade students. Perhaps, without your even realizing it, your explanation of the distributive property was undermined by your sixth-graders' misconception about the meaning of parentheses in a mathematical equation. Perhaps cultural differences between your background and that of your first graders means that they enter your classroom with a different vision of "family" than you do, a fact that simply must have implications for how you present your project-based unit in which students are making books about their families.

The Art and Challenges of "Explaining"

The notion of "getting into the students' minds" is closely related to the notion of "explaining" something well. Ensuring that your students truly master your objective begins with a realization of just how difficult "explaining" an idea can be.

Of course, our naiveté is understandable, given that we all have plenty of experience explaining things. We give directions to a stranger who is trying to reach the store; we tell our friend why we have decided to teach; we describe our choices to a waiter. Unfortunately, those day-to-day experiences as "explainers" may give us a false sense of accomplishment and expertise. (Moreover, if we are really honest with ourselves, those explanations are probably rarely actually completely effective. Have you ever realized, seconds after ending the conversation that you just sent a stranger off with bad directions?)

The stakes in those scenarios are rarely as high—and the challenges rarely as complex—as those in the classroom. As one new teachers' guide warns, "The ability to deliver clear and accurate explanations, and especially impromptu ones, does not come naturally to the majority of teachers. It is a skill that you need to deliberately cultivate if you are to become competent."[20]

Even if only subconsciously, we are naturally inclined to think of *ourselves* as the audience for the lessons we are planning. Because we may have different experiential, knowledge, and cultural reference points from our children, this tendency leads to mismatches between what happens in our minds and what happens in the minds of our students. Excellent teachers, however, work against that natural inclination and are able to step out of their own minds and into the minds of their children, asking themselves constantly, "How will this be received? What will my students hear when I

[20] MacDonald, Robert, and Sean Healy. A *Handbook for Beginning Teachers*. Longman: New York, 1999, p. 166.

say this? What will be going on in their minds as I give this lesson? How should that change my instructional methods and explanations?"

Here, we have attempted to gather several specific approaches that will help you maintain focus on your students' frame of reference. This section will encourage you to:

(1) Break down concepts into an appropriate number of discrete pieces and then put them back together for students in a meaningful way,
(2) Explore and build on students' prior knowledge using "knowledge bridges" such as analogies,
(3) Investigate and embrace students' cultural reference points that may be different from your own,
(4) Uncover students' misperceptions about your subject matter in order to navigate and correct those in your instruction, and
(5) Always consider students' motivation, taking advantage of opportunities to emphasize in an age-appropriate way the functional nature of the objective.

A. Breaking Down Concepts Into an Appropriate Number of Manageable Parts

Successful teachers constantly weigh the conceptual difficulty students may have when they are exposed to a complex idea (such as writing a persuasive essay) and the real limits on the amount of knowledge and number of ideas that students can process at one time (topic sentence, supporting evidence, persuasive tone, sign-posting, closing arguments, etc.). That is, one teacher might (mistakenly) think that if his students read enough models of good persuasive essays, they will "get it," picking up over time on the characteristics that make good writing. Another teacher might break the general concept of "persuasive essay" into twenty-three component parts and teach each of those parts thoroughly, (mistakenly) believing that the students will therefore be able to write a great persuasive essay. Neither teacher's students are actually going to achieve mastery of that objective.

A teacher who is considering the objective from a students' perspective will realize that both instincts have merit—the overall concept of a "persuasive essay" is in fact too complex an idea to teach all at once, and the long list of parsed components of a persuasive essay would be overwhelming to students in most, if not all, grade-levels. One aspect of "getting into your students' minds" is recognizing the amounts of information that can be received and processed by your students at one time.

A similar problem with the same results is that new teachers sometimes fail to realize all the component parts of a concept that they need to teach. They fail to parse the concepts in the first place. Before you teach the distributive property, for example, students have to be taught the role of parentheses in math, the order of operations, how to multiply integers, etc.

I had to teach my seventh graders how to write their own piece of fiction, and I remember the moment I saw a fellow teacher's handout on the "plot map." There it was: the five basic parts of a plot–setting the scene, the problem, the rising action, the climax, and the resolution. I realized my class could learn these basic concepts, then search for them in stories and television shows, and finally write our own plots. I had read thousands of stories before seeing the plot map, but it was that tool that helped me break down the idea of plot into manageable pieces. As a result, I began to devise the equivalent of the plot map in all of the forms of writing I taught.

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In breaking down complex concepts, as a general rule you should limit your key, "take-home" ideas (those central concepts that you would want your student to explain to someone who asks "what did you learn today?") to three to five concepts. Those concepts may certainly have sub-points, but you should force yourself to be able to summarize your lesson in no more than five bullet points.

Of course, the size and quantity of these "pieces" of information is not an exact science and may vary by grade level. While the generalizations made in the cognitive development chapter should give you some guidance, ultimately you have to check for students' understanding constantly, and determine as best you can when students' failure to understand was a result of putting too much on their plate at once.

B. ...And Putting Them Back Together Again

A problem closely related to some new teachers' inclinations to teach a holistic concept without breaking that concept into component parts is some teachers' failure to pull those parts back together in the holistic concept once the atomized pieces are taught. That is, we often put so much energy into figuring out how to parse down a complex concept so that it is manageable that we fail to follow through by bringing all of those pieces back together in the students' minds so that they have a command of the general concept. This problem was a stumbling block for the teacher in the introduction who tried to teach the evolution of our concept of the atom.

If we are really "getting into the students' minds," we would realize that the students may understand each piece of a lesson without mastering the larger, take-home message.

The moment I was teaching 3rd graders how to "borrow" in subtraction, I realized that I had never really understood why we "borrowed" either! I had to teach the concept of how "borrowing" was to actually take 10, or 100 or 1000 from the number to the left and add it to the one on the right. Using base ten blocks and manipulatives allowed them to understand what they were doing, not just how to do the calculation.

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Consider the following description of a creative, but incomplete, lesson:

> Ms. Carson, a ninth grade geography teacher, has written her lesson objective on the board: Students will be able to describe how the greenhouse effect adversely affects the Earth's temperature. When class begins, she shows students two thermometers at the window, one inside a plastic soda bottle and one directly on the sill. She has three different volunteers note and verify the two temperatures and asked the rest of the class to record the data in their notebooks.
>
> She then describes what "solar radiation" and the atmosphere are, and students write down her definitions. She draws a picture of the Earth and its atmosphere on the board, and she shows how both absorb or reflect beams of sunlight and infrared radiation. Students copy down the drawing.
>
> Next, Ms. Carson takes out a series of signs, each with a different chemical symbol on it. She explains that these different chemical combinations, called gases, make up the atmosphere. She notes the different names of the gases and describes how each of these gases are created both naturally and through human activity.
>
> After students take more notes, volunteers check the thermometers and notice a slight difference between the two temperatures. They again record their observations.
>
> Finally, Ms. Carson asks several other students to come to the front of the class and hands each student a sign, representing either the sun, a beam of sunlight, the earth, or one of the gases discussed earlier. She arranges the students to simulate a beam of sunlight hitting the earth's surface and being unable to leave because of the concentration of gases. The teacher summarizes that the students have just witnessed the process of the greenhouse effect. The bell rings.

In some ways, this is a good lesson. It generally follows a lesson plan form. It appeals to various learning styles. Can Ms. Carson be sure, however, that her students understood how the greenhouse effect works? One of her best tools for demonstrating that cause-and-effect idea was the thermometers,

one in a bottle and one not. And yet, Ms. Carson makes no attempt to connect all of the various components of the greenhouse effect that she is demonstrating with the general concept of "greenhouse effect" that is represented by the thermometers experiment. We have little confidence that her students could explain the relation between the diagrams on the board or the signs were that held up and the thermometers. What did the plastic bottle represent? How does that experiment demonstrate what the diagrams and signs are communicating? What was the effect of the beam of light being trapped in the bottle? *How* is that an analogy for the greenhouse effect?

Within these questions lie what *should* have been the "take-home" messages from this lesson. When asked "what did you learn today?" a student *should* have been able to respond:

> The greenhouse effect is a slow warming of the earth that is caused when sunlight enters the earth's atmosphere, bounces off the earth's surface, and then can't escape the atmosphere because of pollutants that humans have put into the air. We proved that this happens by trapping sunlight in a bottle. The plastic of the bottle represented the earth's atmosphere. When we trapped sunlight, the temperature rose, just like what scientists believe is happening on Earth due to pollution.

Ms. Carson, like many new teachers who get wrapped up in the atomized "activities" that they have developed, failed to pull those pieces together in a way that would allow students to meet her objective. You must be wary of the tendency to lose sight of the ultimate purpose of your lesson, and instead explicitly build back up what gets broken apart for the purpose. Similarly, this means considering what students are likely to be thinking about during your lesson. Was the student representing the sun in Ms. Carson's class thinking about solar radiation, or how he looks in front of the rest of the class? This is not to say that you cannot include engaging activities in your classroom, but you may be sacrificing the clarity of your message for unnecessary razzle-dazzle.

As with all of these strategies, the key to successfully avoiding this problem is to put yourself in the place of the students. Ask yourself as you lesson plan whether a student will understand what and why each step in the lesson is happening. Ask yourself whether the "take-home" message of your objective is clear. Without a real synthesis of key ideas, you risk walking your students through a series of specific (perhaps creative) activities without the students ever getting the point.

C. Building on Students' Prior Knowledge

Imagine attempting to teach students the distributive property in a way that truly starts from scratch, without being able to assume any prior knowledge at all. It's a mind-boggling thought experiment. There must be something—addition, multiplication, knowledge of numbers, language itself?—from which to build. Like a geometric proof, all teaching starts with some "given," pieces of prior, familiar knowledge in the student's mind that the teacher invokes as a foundation for the new knowledge that is being taught.

To maximize your effectiveness as a teacher, you have to (1) know what your students' prior knowledge and experiences are and (2) take advantage of them. The first requirement is fulfilled by a combination of general assumptions that you make about students of that age, specific information that you have from student assessments, and other information that you have gleaned from your formal (student interest surveys) and informal (daily conversations) inquiries into your students' lives. These investigations map out the foundation of prior knowledge on which a new teacher can build. Fulfilling the second requirement means thinking about an upcoming objective and students' base of knowledge simultaneously, finding common ground to start from in your quest for mastery of the objective.

Consider the following, relatively simple, illustration of a teacher's use of a student's prior knowledge:

Student: In this story, these boys have a "rivalry." What does that mean?

Teacher: Well, think about your relationship with your older brother Mike. I know you respect and admire him, right? I remember that you wrote about that big fish he caught.

Student: Yes.

Teacher: At the same time, do you ever compete with him? Do you sometimes fight over something, or try to out do each other?

Student: Yes. We fight over the front seat sometimes. And we always compete to jump our bicycles highest.

Teacher: Sometime people call that a "sibling rivalry"—a rivalry is a relationship that involves a lot of tough competition.

Student: Like, maybe, a football game?

Teacher: Absolutely. People often call teams that compete really hard with each other, "rivals." You play soccer. Which team that you play would say is your biggest "rival"?

Student: Probably the Blue Jays. We had an overtime game last time and we won. I bet the next time we play it is really a hard game because they really want to beat us.

Teacher: So, the Blue Jays are your "rival." That's exactly right. They are a team that you have intense competition with. Now, let's think about this word in the story. What does the word "rival" tell you about these boys in your story? . . .

Thus, in terms of cognition, this teacher has adeptly hooked a new word to a concept that the student already had in his mind, a much more successful technique than simply defining the new word for the student. Note that to do so successfully, the teacher had to have a foundation of knowledge about the child's prior experience.

Analogies. One particular form of accessing prior knowledge is the use of analogies. Much like the teacher in the dialogue above, you can sometimes build a "knowledge bridge" from something a student knows and understands to some new concept through carefully chosen analogies. In fact, most of us use these unconsciously all the time. As a teacher, we have to pull this technique into the front of minds, to think deliberately about what analogies are going to be most effective with your students. Again, the starting point of the analogy will depend on students' prior knowledge. Consider these examples:

- "DNA is the shape of a spiral staircase," might be appropriate for younger students, while for twelfth grader who have studied geometry, you might say "DNA is shaped like a double-helix." In both cases, you would realize the need to show a picture.

- For younger students, you might teach the human body's systems in terms of a factory, drawing connections between bones and buildings, between nerves and electrical wires, between muscles and machines, etc. (Of course, such a metaphor would probably too oversimplified for older students, although assigning an older student to write a paper that compares and contrasts the human nervous system to a community's communications systems might be an effective way to develop and check for understanding.)

- With younger children, you might make analogies between the national presidential race and a class-wide election of hall monitor. Save your more abstract comparisons for older students; you might make a three-pronged scale to serve as an analogy for the give-and-take, checks-and-balances relationship among the three branches of government.

Schema, Assimilation, and Accommodation—
Our Brain's Organization of Prior Knowledge

Some theorists suggest that most of the information stored in long-term memory is organized as schemas—organized bodies of knowledge about particular objects or phenomena. Schemas are essentially generalizations that our minds make about categories of ideas. For example, as children, we developed sets of characteristics that we associate with fruit and with vegetables. Probably, at some point, we encountered a more advanced definition of "fruit" and "vegetable," learning that fruits have internal seeds. Suddenly, we have to adjust our schema for fruit to include tomatoes. Schemas become particularly important with children interpreting experiences for the first time. Children might call a whale a "big fish," reflective of the child's schema that all creatures that live in the water are fish. A very young child might call a cat a dog if all four legged creatures she has previously encountered were dogs. As a teacher, we have to be aware of and "accommodate" those schema by helping students reorganize their mental view of an idea, creating more and more sophisticated schema. This concept has broad implications for you as a teacher. In terms of building upon students' prior knowledge, you will need to identify and teach "from" children's existing schema for a given idea. In some cases, your responsibility will be to break down and reinvent the schema children bring to the classroom.

Do keep in mind that an effective "knowledge bridge" has to be initially anchored to a concept that the student knows very well. So, the human body analogies described above might fall flat if your students have no idea how a factory works.

Analogies, metaphors, similes, representations, and word pictures are often excellent means of bridging from students' prior knowledge to a new idea. They must be used, however, with an element of caution. By definition, analogies simplify the concepts you are teaching. You must take care that students do not fail to move from one side of the bridge to the other, thereby coming away thinking that DNA *is* a spiral staircase, for example. The spiral refers to its shape and nothing else. You should make it a habit when using analogies to also discuss the differences between the two objects being compared, although that discussion should probably come after a discussion establishing the analogy has occurred.

D. Learn about Students' Cultural and Experiential Reference Points

No matter what your background, ethnicity, race, gender, sexual orientation, or experience, it is guaranteed to be different from each of your student's. Using that premise as a starting point, you should explore those differences with an eye for students' prior knowledge, reference points, and schema from which you can build additional knowledge. The example about cultural perspectives of "family" is just one, of many. Something as simple as the different meaning of the word "lemon" in Spanish and English can trip up understanding of a story or analogy. Cultural dialects can complicate formal grammar lessons. On a grand scale, the gross under-representation of some students' heritage in some textbooks

can be demeaning and confusing to students, and interfere with your own academic goals for your students if you do not foresee and address that concern. Perhaps you are teaching in a community where the average age of marriage for girls is much younger than the "norm" you have in your mind. How does that fact influence your discussion of a short story about an arranged marriage? Perhaps some of your students have family members in gay relationships? Perhaps most of your students do not? How do those facts inform your discussion of a short story about a close relationship between two men?

Mistakenly, I selected Charlotte's Web *to read with my third graders. I was so excited to be reading a novel with them that was above third grade reading level that I completely forgot to think about how this story could relate to their lives. As we conducted our pre-reading activities, I heard lots of questions. "What's a plow? Why do they have pigs in their backyard? How come Mrs. Arable doesn't have a job?" Wow! I don't know how I overlooked this one! We ended up comparing the lives of Fern and Wilbur with our lives. We wrote a different version of* Charlotte's Web *that would take place in Compton. We were able to make adjustments and talk about different cultures. In the end, it was a successful unit, but it is an example of not thinking strategically about my students and their prior knowledge before planning. Not to say they should not read books like* Charlotte's Web *(they loved the story, and it certainly expanded their horizons), but we needed to talk about some clear differences in order for them to be invested in reading it.*

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Overlaying these larger ethnic, cultural, gender, and sexual orientation reference points are a whole world of experiential reference points that are direct products of students' lives in their communities, families, and schools. Perhaps several of your students come to you from families for whom the "government" (in the form of social workers and police) is a very real presence in their lives. How will the "schema" they have for the concept of "government" play out in your discussion of various *forms* of "government" around the world? Perhaps your students have never traveled outside of their community or state. How will that fact influence your approach to designing d=rt word problems for your math class?

Through the *Diversity, Community and Achievement* text, we will explore the dynamics of difference and sameness between you and your students (and among members of your class) that should be part of your consideration of how to best reach and teach your students. Just as it is your responsibility to explore and build from students' prior knowledge, it is your responsibility to explore and acknowledge your students' life backgrounds in your instruction.

E. Recognizing and Overcoming Students' Misperceptions

A corollary to the principle that you must know and use students' prior knowledge is that you also must be aware of and address students' misperceptions that may affect their reception of your instruction. Inaccurate or absent information can have a significant impact on a student's ability to process new ideas and should be built upon or consciously shifted when explaining a related concept. (As you study Content Pedagogy this summer, you will consider some of the common misperceptions that students of a particular age bring to various classes.)

Consider the following examples of misperceptions that students might bring to a classroom:[21]

Earth Science, Grade Six

Fact: The earth revolves around the sun.

Misperception: The sun revolves around the earth. It "rises" in the morning and "sets" in the evening, at which point it "goes" to the other side of the earth.

[21] Ormrod, Jeanne. *Educational Psychology: Developing Learners* (4th Ed). Prentice Hall: New York, 2002.

Language Arts, Grade K

Fact: The /s/ sound can be made by an "s," or a "c."
Misperception: The /s/ sound is made by only by an "s."

Life Science, Grade One

Fact: A living thing is something that carries on such life processes as metabolism, growth, and reproduction.
Misconception: A living thing is something that moves and or grows. The sun, wind, clouds, and fire are living things.

Geography, Grade Eight

Fact: Rivers run from higher to lower elevation.
Misconception: Rivers run from north to south, "down" a map.

In each case, the teacher must foresee those misperceptions in order to most effectively plan a lesson. This is especially important when the teacher is teaching a skill or idea that assumes background knowledge of a particular concept. A lesson that does not take on the misperception will be highly confusing to a child who is trying to reconcile his or her "known" information with this new information presented by the teacher. Even adults have been shown to ignore material that contradicts their prior knowledge – and to actively seek out information that confirms their existing beliefs.[22] Often, the best way to take on these misperceptions is to address them explicitly as part of your lesson.

In order to uncover the root of misunderstandings, teachers should consider exploring the concepts that students have already formed (or mis-formed) in their heads before instruction. In one example, from the book *Learning to Question, Questioning to Learn*, a teacher presents a second grader, Christy, with four sentences.

1. John has a pet snake
2. Do the Power Rangers come on at 4
3. Is the school lunch bad
4. We have Fall break on October 10

Christy is to decide which sentences require question marks. She chooses numbers two, three and four. The teacher attempts to explore why:

Teacher: OK, what makes sentence 2 is a question?
Christy: The Power Rangers come on at 6:00, not 4:00.
Teacher: So what makes that sentence a question?
Christy: They don't come on at 4:00. I was baffled, but I continued.
Teacher: Let's leave sentence number two. What makes sentence number 3 a question?
Christy: I don't think the school lunch is bad. Some kids do.
Teacher: So why does it end with a question mark?
Christy: Because we can't agree.
Teacher: If you don't agree with something, it's a question?
Christy: Yes.
Teacher: Hmm, what about sentence number four, what makes you say that it needs a question mark?
Christy: Fall break is on October 3rd, not on October 10th.

[22] Holt-Reynolds, D. "Personal history-based beliefs as relevant prior knowledge in course work." *American Educational Research Journal*, 29, 325-349.

The teacher, who has been teaching punctuation marks for five years, found this line of questioning extremely helpful. "I never really probed my students' thinking to find out why they punctuated correctly or incorrectly," she said. "I now realize how valuable this is. … In Christy's case, she was determining if something was true or not. If it was true, then it had to end in a period. If it wasn't true or she was unsure about the answer, then it ended in a question mark."[23] So often, teachers do not take the time to determine *why* a child is not answering questions correctly. The phenomenon of concept formation reminds us to be precise when helping students learn new ideas – and to be investigative when students are not performing as expected.

F. Considering Student Motivations

In each of the other texts, we discuss the importance of motivating students to learn. In most of those cases, we discussed that idea on a macro-level—how one motivates students to want to learn generally. That same principle applies on a lesson-by-lesson case. Successful teachers are also effective at "getting inside their students' minds" enough to know why this particular objective could be enticing to them.

The *Washington Post* asked teachers and students about their most effective or interesting school assignment.[24] Peter Petrossian, a middle school science teacher at Pyle Middle School in Bethesda, captured students' interest with a lesson on DNA fingerprinting:

> It's so common now to either read in a magazine or see on TV how this technique is used to do everything from find a murderer, identify a relative or biological mother or father, or even to identify new species or genes. The kids get a make-believe scenario where a little old lady's dog (Poopie) has been dog-napped and they need to solve the crime: "Who stole Poopie?" They get real vials of DNA (found at the scene of the crime and obtained from the suspects). They set up the equipment, make all the solutions and gels, and run the experiment. Then they analyze their results and solve the crime. Twenty years ago, these procedures weren't even available to anybody -- now I've got 7th graders doing it!

You would probably need to write a grant to obtain the equipment necessary to execute such a lesson. But if you did, you would surely be giving your students an educational experience they would never forget. Meanwhile, with most motivating lessons, you don't need money—just a creative spin. Successful lessons tap into students' sense of curiosity and interest in investigation. Ben Kraftchick, a seventh grader at the Gulliver Academy in Miami, told the *Post* how much he enjoyed preparing for a Halloween debate assigned in speech and debate class.

> This debate was going to determine the greatest of the three classic movie monsters: Frankenstein's monster, Dracula, and the Werewolf. I represented Frankenstein. In support of my contention that Frankenstein was the most powerful, I pointed out: (1) His powers are not limited to specific times; Dracula is powerful only at night and the Werewolf only on the full moon. (2) If Frankenstein were actually attacked and bitten by one of the others, he would gain their powers, in addition to his own. (3) Frankenstein is reparable. Even if he is severely injured and even killed, all you need is a mad scientist (of which there are plenty in the movies) to repair him. If you were representing Dracula, you might point out that he has the power of hypnotism with which to control the other two monsters, as well as immortality (absent a wooden stake, of course) and the ability to create other vampires. With enough vampires, you could overcome Frankenstein. If you

[23] Dantonio, Marylou. *Learning to Question, Questioning to Learn.* Boston: Allyn and Bacon, 2001, p. 179.
[24] Strauss, Valerie. "Effective Assignments, From DNA to Dracula," *Washington Post*, January 5, 2004.

> were representing the Werewolf, you might point out his superior strength and ability to turn others into werewolves. Again, with his strength and fellow werewolves, he could overcome Frankenstein.

Successful teachers often also stress the functional aspects of the new skills or knowledge so that students recognize the usefulness of mastering that objective. Students more quickly and efficiently grasp explanations that they view as directly bearing on something they are trying to do or do better. (This point is closely connected to the *Teaching As Leadership* model's focus on investing students in their academic goals. Once students are invested in their own success, these day-to-day motivations become considerably easier.) While it can be easily argued that students should learn to appreciate certain knowledge simply for its beauty and pleasure, MacDonald and Healy emphasize the need to connect learning to the students' vision of usefulness:

> When students don't see any usefulness in what they are learning, you should work to build the use of it into your explanations. The younger the students, the more need there is to make explicit the functional and operational dimensions of all new learning. Teacher explanations should tell students: "This is how it works," "this is what you do with it," "this is the need it helps us to satisfy." Always aim to have students perceive that what they are learning has an identifiable use.[25]

If you are teaching students how to derive the area of a space, develop work problems that are based on real spaces that students are interested in. What is the area of the classroom? Of their room? Of the gym? Of the school? If you are working on writing objectives, create products that will be "published" in a way that shows writing's usefulness. Write letters to local politicians who will then come to class. Write books that can be shared with family. Through it all, you should also be reinforcing messages about the long-term value of these skills in terms of increased opportunities after school.

Conclusion and Key Concepts

If the three teachers in the introduction had been more deliberate in "getting into their students' minds" as they designed their lesson plans, their lessons would have been more successful. If these teachers had first recognized the weighty difficulty of "explaining" a concept, and had then thought critically about their students' prior knowledge, cultural backgrounds, experiential reference points, and potential misperceptions about the subject matter, the students in their classrooms would have been more likely to have truly mastered the objective.

The first teacher, for example, would have isolated the influences of sun, water, and nutrients, perhaps conducting experiments with controls for those various factors, allowing the students to discover that the absence of any of those factors undermines growth. In the second example, if the teacher had viewed the lesson from the students' perspective, the teacher would have realized that the lesson was teaching pieces of the desired objective, but not the objective itself. The teacher would have involved the students in drawing out similarities and differences among the three models, to show the evolution over time.

The third teacher, facing the difficult question about how planes fly, would have thought about a fifth grader's frame of reference and would certainly not have recited an answer that he or she learned in college. Instead, the teacher would have thought about ways to reach the knowledge by building on what a fifth grader knows. For example, the teacher might first tear a strip of paper from a notebook, asking the child to hold one end of the strip just under her mouth as she blows across the top of it. When the

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[25] MacDonald, Robert, and Sean Healy. A *Handbook for Beginning Teachers*. Longman: New York, 1999, p. 174.

paper rises upward, the teacher would explain that when air goes faster over the top than the bottom of something, it pulls the object upward. Having "proven" that fact to the child and made sure the child understood that point, the teacher might say "So, the real question here is why is it that air moves faster over the top of an airplane wing than under it?" Using some diagrams on the board—and better yet some student running around a giant profile of a wing on the playground, the teacher would next demonstrate that air has to travel farther and therefore travel faster over the top of the plane's wing because of its shape. (Not an easy concept for a fifth grader, but doable!)

As a teacher concerned with your students' mastery of your objectives, you must invest considerable time and energy in thinking about how your students will hear, see, and receive the information that you are presenting. What, in their minds, is the starting point for the discussion? Is that starting point a useful platform for you to build from or is it a dangerous misconception that could undermine the rest of your lesson? Few teachers are able to lead their students to significant academic gains without "getting into students' minds" while they plan their instruction.

Having read this chapter, you should recognize that the key to "getting in the mind" of your students is to inform your instruction with student perspectives by:

- Breaking down concepts into manageable parts
- Re-synthesizing those parts to teach students the overall concept
- Building on students' prior knowledge
- Considering students' cultural and experiential reference points
- Recognizing and overcoming students' misperceptions
- Considering student motivations

Teaching Higher-Order Thinking

Chapter Five

I. What Is Higher-Order Thinking?
II. Why Do We Want to Teach Higher-Order Thinking?
III. How Do We Teacher Higher-Order Thinking?
IV. The High Investment of Higher-Order Thinking

> *Students do not **understand** in the most basic sense of that term. That is, they lack the capacity to take knowledge learned in one setting and apply it appropriately in a different setting. Study after study has found that, by and large, even the best students in the best schools can't do that.*[26]

For decades, public schools prepared children to be good citizens—and good factory workers. Students were expected to sit, listen, and do exactly as they were told. In some respects, this model served high school graduates well since they learned to follow directions in ways that would be valuable to their future employers.

As economic and technological changes shape the occupational outlook of today's students, schools have begun to embrace the need to instill "higher-order thinking" to prepare the 21st century workforce. No longer is it enough for high school graduates simply to know basic facts and skills. To be successful, students must master decision-making, prioritizing, strategizing and collaborative problem solving.

This chapter explores the role of higher-order thinking in the classroom. After first attempting to define the concept, we will then discuss why teachers should strive for more and more demanding thinking from their students. In the final section of this chapter, we discuss specific techniques for fostering higher-order thinking in your classroom.

I. What Is Higher-Order Thinking?

In 1987, the National Research Council sponsored a project that attempted to synthesize all the many theories about higher-order thinking. The express goal of the project was to make recommendations about how to foster higher-order thinking in students. While lower-order thinking is more easily defined as mastering facts (such as being able to describe the parts of the water cycle) or completing a task with specific steps (such as being able to solve a two-variable equation), that study ultimately describes higher-order thinking as thinking that is (or involves):[27]

"Non-algorithmic"	Involving paths of action for solving problems that are not specified in advance (creative problem solving)
Complex	Involving problem solving where multiple solutions are possible
Effortful	Involving considerable mental energy directed toward problem solving
Nuanced judgments	Involving subtle, less-than-obvious decisions about strategies
Application of multiple criteria	Involving transferal of some (sometimes conflicting) criteria to the problem solving process

[26] Gardner, Howard, quoted by Ron Brandt. "On Teaching For Understanding: A Conversation with Howard Gardner." *Educational Leadership*. April 1993: Vol. 50 No. 7, p. 4.

[27] National Research Council, Committee on Research in Mathematics, Science, and Technology Education. "Education and Learning to Think." Report published 1987.

Uncertainty about what is known	Involving problems that do not provide a clear starting point
Self-regulation	Involving some degree of meta-cognition and self-awareness about strategies being employed
Imposition of meaning	Involving development and application of new theories onto sets of facts and problems

Overall, "higher-order" thinking means handling a situation that you have not encountered before and is generally recognized as some combination of the above characteristics. It is thinking that happens in the analysis, synthesis, and evaluation rungs of Bloom's ladder. By contrast, "lower-order thinking" is simple, reflex-like, transparent, and certain.

So, you know that your students are engaged in higher-order thinking when they:

- Visualize a problem by diagramming it
- Separate relevant from irrelevant information in a word problem
- Seek reasons and causes
- Justify solutions
- See more than one side of a problem
- Weigh sources of information based on their credibility
- Reveal assumptions in reasoning
- Identify bias or logical inconsistencies

Clearly, advanced forms of higher-order thinking may be out of reach for a kindergarten student who is not yet able to engage fully in abstract thought. (See chapter two.) Higher-order thinking in all its many forms is, however, an attainable goal in all classrooms at all grade levels. Kindergarteners can be problem solvers; you can still lead them to think about creative solutions to problems and to draw a diagram to help think about a puzzle.

Although some critical mass of lower-order thinking in the classroom is necessary as a foundation for reaching higher-order thinking skills, it does not justify the overwhelming emphasis in this nation's classrooms on the lower-order knowledge and skills to the exclusion of higher-order thinking. "[W]e can safely say that an emphasis on facts is the 'norm' for the United States and the emphasis on thinking represents an occasional deviation from this norm."[28] Byrnes also points out that these deviations seem to be a function of periodic public dissatisfaction with the standard approach of emphasizing facts, a dissatisfaction that is most commonly stoked by some major technological advance such as Sputnik, or the computer boom.

Among the primary reasons for this focus on lower-order thinking skills may be the simple fact that lower-order thinking skills are easier—easier to understand, easier to teach, easier to test, easier to learn. So, why do we want to leave this comfort zone to reach for higher-order thinking skills for our students?

[28] Byrnes, James P. *Cognitive Development and Learning In Instructional Contexts*, 2d ed. Allyn and Bacon: Boston, 2001, p. 91.

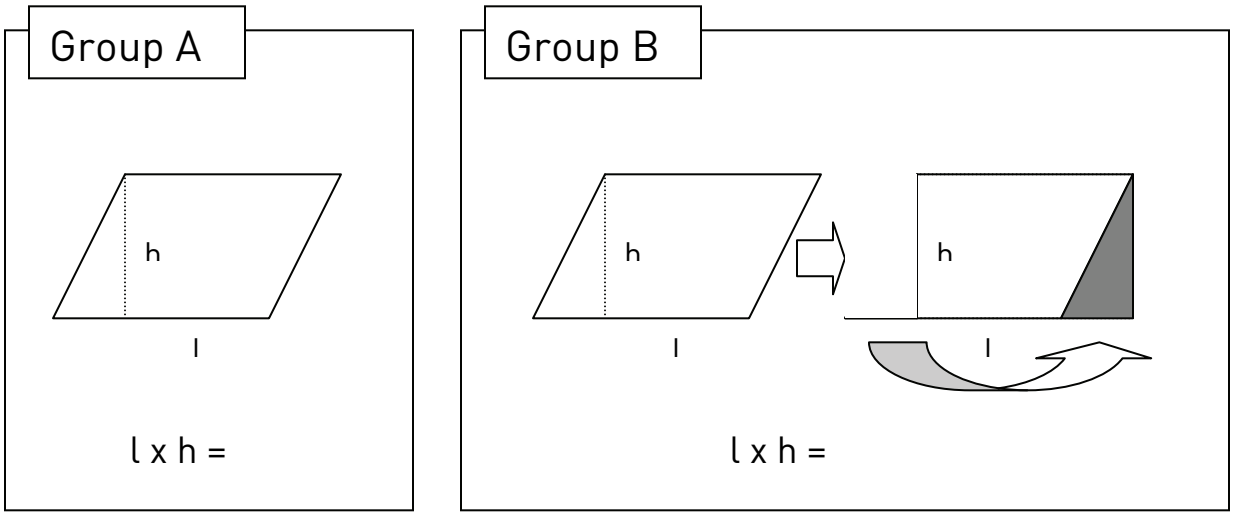
II. Why Do We Want to Teach Higher-Order Thinking?

We push toward higher-order thinking skills in the classroom because they have enormous benefits for our students.

The reasoning here is similar to the rationale for pushing knowledge into our long-term memory. First, information learned and processed through higher-order thinking processes is remembered longer and more clearly than information that is processed through lower-order, rote memorization. Consider for example, the difference between memorizing a formula and explaining the derivation of the formula. Or, the difference between memorizing the definition of a new word and internalizing strategies for discerning the probable definition of the word from its context. Or, the difference between mere memorization of the multiplication tables and a deeper understanding that the multiplication tables represent short cuts for addition. Or, the difference between reciting the events included in a history textbook and drawing inferences from a number of historical documents. In each case, a student who has the latter-type of understanding will carry that knowledge longer.

Moreover, the student with the deeper conceptual knowledge will be better able to access that information for use in new contexts. This may be the most important benefit of high-order thinking. Knowledge obtained through higher-order thinking processes is more easily transferable, so that students with a deep conceptual understanding of an idea will be much more likely to be able to apply that knowledge to solve new problems.

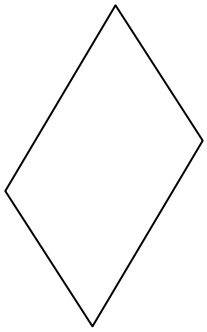
In a well known study showing that students are more likely to apply a skill to solve new problems when they have a deep conceptual understanding of that skill than when there is a lack of this conceptual understanding, one researcher used two methods to teach children the "drop-perpendicular" method for computing the area of a parallelogram.



Students in Group A simply memorized by rote the "drop perpendicular" method and applied it to the shape, successfully finding the area of the parallelogram.

Students in Group B were provided the *reasoning* behind the process. They were shown how one could cut off a triangular portion of a parallelogram and re-attach it at the other end to make a rectangle. The students were led to understand that the method is actually a simple variation on the "(length) x (width) =

(area)" formula that they already knew for rectangles. This set of students, Group B, then applied the method and, like Group A, successfully found the area of the parallelogram.



Then, when children were presented with a parallelogram in an unusual orientation, the Group A children incorrectly applied the process, arriving at an incorrect answer. The Group B students, having an understanding of why the formula works, adjusted the method to fit the new orientation and derived the right answer.

Heuristics: Tools for Solving Problems

Heuristics are general problem-solving strategies that may help students tackle difficult questions. You can practice these techniques with your students and then provide novel situations for them to apply their newly acquired skills

(1) Do not focus only on the details; try to see the forest as well as the trees.
(2) Do not rush to a solution rashly.
(3) Try working backwards by starting with the goal.
(4) Create a model using pictures, diagrams, symbols or equations.
(5) Use analogies: "What does this remind me of?"
(6) Look for unconventional or new ways to use the available tools.
(7) Discuss a problem aloud until a solution emerges.
(8) Keep track of partial solutions so you can come back to them and resume where you left off.
(9) Break the problem into parts.
(10) Work on a simpler version of the problem.

This sort of higher-order "transfer" of understanding is the key to good thinking and problem solving. Good thinking and problem solving skills make learned knowledge applicable in the real world. As teachers of students who are often lagging behind their peers in better resourced schools, we have a mandate to do all that we can to ensure that our students are engaging new knowledge at a level that will allow them to transfer it to new real-world applications. If our students can add numbers with decimal points, can they add prices in a store? If our students can write a persuasive essay, can they write a letter to their banks requesting a loan, their senators arguing policy points, or, someday, their children's teachers calling for high expectations for their children? If our students can list the steps in the scientific method, can they also recognize that the conclusions drawn by a polluting company failed to be reached using that scientific method?

III. How Do We Teach Higher-Order Thinking?

The importance of higher-order thinking makes it a priority in our classroom, but how does one teach towards higher-order thinking? How does one foster the kind of deep conceptual understanding that is transferable to various academic contexts and, perhaps more importantly, to real-world problems? We have gathered here various strategies for doing just that:

(1) Teach skills through real-world contexts. Because higher-order thinking is difficult—after all, you are asking students to make decisions, rather than simply follow a prescriptive path—it will help your cause if you build motivation for the tasks you have developed. If you are teaching your students when to use the various arithmetic operations, set up a store in your classroom. If you are studying persuasive writing, have all students write a letter to a local leader on some hot-button topic in your community. If you are considering how to teach the scientific method, look for community issues that will simultaneously motivate your students and provide them an authentic context for applying the skills you are teaching.

[Note that this strategy is—like all others in this chapter—a variation on "getting inside your students' heads." Successful teachers think carefully about how students will hear and receive information, and they consider the various contexts within which their students could use a new skill or knowledge.]

(2) Vary the context in which students use a newly taught skill. Another prerequisite for higher-order thinking is flexible approaches to problem solving. In addition to an emphasis on one real-world application of skills, a teacher should work to introduce students to a variety of real-world contexts in which a particular skill is used. The more settings in which a student uses some new element of knowledge, the more the student internalizes the deeper conceptual implications and applications of the knowledge. (For example, to teach addition of numbers with decimal points, have students work with and add decimal-laden temperatures, metric-based measurements of the lengths of walls, and the scores from skating competitions.) By coming at a skill from many different angles, you will loosen the contextual grip that a student's mind may have linking a particular skill with a particular circumstance.

(3) Throughout your instruction, take every opportunity to emphasize the building blocks of higher-order thinking. Teach content in ways that require students to:

- **Build background knowledge.** The more your students are gaining and retaining information about the world around them, the more they bring to the table when solving complex problems. Help students tap into what they already know, which might just be the information needed to answer a challenging question.
- **Classify things into categories.** You might, for example, have your first graders develop and create categories for a series of words based on their structure. (Students might come up with categories based on first letter, ending letter, or vowel sound.)
- **Arrange items along some dimension.** As you are teaching students to write persuasive essays, you might provide students with five different essays of different qualities, asking the students to rank them and explain their ranking.
- **Make hypotheses.** In any type of "discovery learning," ask students to mentally conduct the experiment before you actually do conduct it. "What do you think will happen when I tape this weight to the side of the ball and throw it?"
- **Draw inferences**. "Having now read these three letters from American soldiers in Vietnam, what can we tell about the experience of being there?"
- **Analyze things into their components.** "What sound does 'shout' start with? How do you write that sound?" or "What influences do you think were weighing on the President's mind when he made that decision?"

Higher order thinking is a very difficult to teach. I have found that thinking aloud is the most effective. Whenever students are being pushed to their academic levels, or being forced to apply what they know, they often need to be shown how to think. They need to be aware that there should be something going on in their head. I always model my thinking aloud. I pretend to be a student in the class and put on a special hat. When that hat is on, I use hypothetical questions that I ask myself out loud. The students know that they are not to interrupt me when I am in this "brain talking" stage. They also know that some of the questions I am asking myself are very easy and should not be answered for me. Students love it and it is an amazing way to model what should be going on in their heads. I try to include higher order thinking in every task. I call them my challenges. Sometimes they are harder for my lower students, but they benefit from them just as much as my higher students.

Frank Cush, Houston '04
Principal, KIPP Schools

- **Solve problems.** Puzzles and problems can be designed for any age level and any subject matter.

(4) Encourage students to think about the thinking strategies they are using. That is, when a student is using context-clues to find the meaning of a word, the student should recognize and think about that strategy as well as the fruits of that strategy. Among the benefits of this sort of "meta-cognitive" approach is that it encourages students to:

- Think analytically about problem definitions ("What do I have to accomplish? What am I allowed to do? What skills can I transfer to this problem? What information is relevant to the problem?")
- Think about planning ("How should I approach this problem? What additional resources or information do I need?")
- Purposefully allocate time and energy ("How do I prioritize my tasks in order to most efficiently solve this problem?")

Specifically, for a teacher, this means delineating and teaching specific problem-attack strategies, giving students time to ponder difficult answers for themselves, and modeling those strategies by thinking aloud to solve problems during guided practice.

Susan Asiyanbi, New Jersey '01, realized that many of her fourth grade math students lacked proficiency in open-ended questions because of their lack of reading comprehension:

> As a result, I had them break down any higher-order problem into five steps: Q (Question), F (facts), St (Strategy), S (solve), and Ch (Check). After modeling how to break down sample problems into these five steps, I required my students to identify and write down the questions asked by the problem, the important facts and the strategy they would use to solve the problem. Only *then* could they solve the problem. Once done, they went back to the question and made sure they answered every part. Children are very quick to solve a problem and often do not recognize that they have not finished all the steps or are not answering the question being asked. These basic five steps ensured me that *all* of my students could feel successful, regardless of reading and/or math level.

Once Susan got her students accustomed to this method of conceptualizing the overall task, she helped them learn different strategies for solving a problem:

> We would begin with word problems that could be easily solved by drawing a picture, and I would model how a picture could represent the problem and thus help them solve it. After my students became confident with using this strategy, I would make the problems more difficult with larger numbers, which would make the "Draw a Picture" strategy pretty arduous. Inevitably, a student would mention that he or she knew another way the class could tackle it. The child would explain the strategy, and the other students would nod in agreement and appreciation. From there, I would give a name to the next strategy, which was often either "Develop an Equation" or "Make a Table," and we'd use this strategy to tackle a series of problems. After a while, my students were proficient in using all sorts of strategies (Draw a Picture, Guess and Check, Make a Table, Recognize a Pattern or Sequence, Solve a Simpler Problem, Work Backwards, Restate the Problem in Your Own Words, Use Logical Reasoning, Develop an Equation, Use Manipulatives to Model the Information).

At this point, my task was to make sure that they could decipher the best time to use a particular strategy in terms of ease and time. It became their job not only to answer a problem, but also to explain how they

answered it, why they chose that particular strategy, and if there was another way that it could be done. Eventually, students were using multiple strategies as a way to check their work!

My eleventh grade English students must be aware at all times that learning is a very real process that is taking place in their lives. Using Reciprocal Teaching has enabled them to be active participants. They constantly annotate the reading process in the margins, noting areas of difficulty or lingering questions. Also, they play "teacher" as much as possible, coming up with questions and answering those questions. It gives them ownership over their learning while forcing them to ask questions at different levels and answer them. One teaching highlight came for me the day we had a Holocaust survivor as a guest speaker during our unit on Night. At the end of the question/answer segment he responded, "Wow, you students ask such great, teacher-like questions."

Theresa Martinez, Miami '04
South Central Programs Manager
Make A Difference

Keep in mind that these techniques can be implemented in all classrooms at all levels. Do not make the mistake of thinking that higher-order thinking should be reserved for older students, or for high performing students, or for supplemental activities. In fact, one of the recommendations from the National Research Council's study of higher-order thinking was that we not wait to move to higher-order. The Council suggested that we teach content at the earliest grades through open-ended complex problems. While some degree of common sense is obviously called for with younger students who may not have the capacity for all forms of higher-order thinking, research indicates that even the youngest of students can be prepared for higher-order thinking through an emphasis on basic problem solving skills. As Byrnes points out:

> All of the developmental approaches have emphasized the fact there is a natural progression in thinking from lower forms to higher forms with age or experience. This developmental progression implies that students need to have a certain amount of education, experience, or practice before they can become capable of the highest forms of thought. . . . And yet, each approach also reveals that it is wrong to assume that teachers should do nothing to promote thinking until students reach a certain age.[29]

This also means that the "lower-level" mastery of basic facts and skills plays a critical role in supporting the development of higher-order thinking. Teachers must give their students a lot of experience making a data table if they are going to expect them to be able to access that strategy to their toolbox when tackling open-ended problems.

IV. The High Investment of Higher-Order Thinking

Teaching to higher-order thinking requires more work from the teacher. Higher-order thinking takes considerable time to develop through lots of practice in different contexts. As researcher Jere Brophy emphasizes, teaching higher-order thinking requires a commitment to class discussion, debate, and problem-solving, all of which take time:

> Teaching involves inducing *conceptual change* in students, not infusing information into a vacuum, [and this] will be facilitated by the interactive *discourse* during lessons

[29] Byrnes, James P. *Cognitive Development and Learning In Instructional Contexts*, 2d ed. Allyn and Bacon: Boston, 2001, p. 80.

and activities. Clear explanations and modeling from the teacher are important, but so are opportunities to answer questions about the content, discuss or debate its meanings and implications, or apply it in authentic problem-solving or decision-making contexts.[30]

More specifically, in addition to the mental rigor involved in developing lesson plans that incorporate higher-order thinking, there are two additional challenges that a teacher takes on. The first is motivation. It almost goes without saying that students are more likely to engage in higher-order, critical thinking when they are highly motivated to do so. Creative teachers capitalize on this connection and therefore (a) use real-world problems that are of genuine concern to students to foster their critical thinking skills, and (b) engage students with compelling challenges to their pre-existing biases, drawing them into analytical debates about difficult issues.

Second, to truly encourage higher-order thinking, a teacher must design assessments and exercises that actually use new and novel situations and problems. This is no small task. But, if at the core of our concept of higher-order thinking is students' ability to apply knowledge to new situations, teachers have to be constantly creating opportunities for that sort of transferal of knowledge. That means *creating* those new situations.

Higher-Order Thinking In Practice—One Classroom's Story

The following reflection by seventh-grade language arts teacher Andrew Mandel, RGV '00, demonstrates one teacher's determination to infuse higher-order thinking into his students' writing:

I noticed that my students were not generating effective support for their paragraphs; their "reasons" to bolster an opinion ("we need to be able to leave campus to buy snacks") were often repetitive or unconvincing ("it's not fair"). So I used the principles of memory theory and higher-order thinking to help them generate stronger ideas. First, by examining successful paragraphs, listing their supporting sentences and categorizing those sentences according to "type," we created a menu of potential reasons that students could use when writing persuasive pieces, including facts ("according to my research, our vending machines charge more than any other cafeteria in the district"), anecdotes ("once, I bought gum from our machine that was so hard that my teeth hurt trying to chew"), and causes and effects ("because we cannot leave campus to buy snacks elsewhere, Candy Incorporated has full control over our urge for food and has no reason to improve"). By creating these categories, students felt much more comfortable trying to generate their own reasons for the various assignments we pursued; they had a framework for accessing their ideas, rather than feeling overwhelmed in one giant pool of thought.

The second piece of the puzzle was showing students the common errors in reasoning that muddied their writing. I explicitly taught potential pitfalls, such as overgeneralizations ("all students hate the dress code"), false cause and effect ("because I have to wear a uniform, I can't concentrate in school"), false assumptions of your audience ("if you get rid of the dress code, then everyone will like you"), and circular reasoning ("I think the uniforms are ugly because I don't like the way they look.") We practiced recognizing these pitfalls in new situations, and my students began noticing quirks in their own writing and thinking. One of my golden moments of teaching was Michael saying, "no one likes that you give homework," and then stopping himself and saying, "well, maybe that's an overgeneralization."

Conclusion and Key Concepts

Having read this chapter, you should understand what is meant by **"higher-order thinking."** You should recognize *why* we want to teach higher-order thinking, understanding that a deeper conceptual understanding of ideas is **remembered longer** and is more **transferable** to other contexts. You should also understand that higher-order thinking is best taught through **real-world contexts** and by varying the scenarios in which students must use their newly-acquired skills. You should emphasize the **building**

[30] Brophy, Jere. "Probing the Subtleties of Subject-Matter Teaching." *Educational Leadership* (April 1992), p. 5.

blocks of higher-order thinking and encourage students to think about the strategies they are using to solve problems.

As victims of the achievement gap, our students need to make significant academic gains just to catch up with many other students and to have an even chance at life's opportunities. One of the ways that you can help provide that chance is to lead, draw, and push students toward higher-order thinking.

Prerequisites to Learning: Nutrition, Sleep, and Health

Chapter Six

I. Nutrition
II. Physical Fitness
III. Sleep
IV. Health
V. Heath Issues for Adolescents
VI. Homelessness

Introduction

Learning theory is about how students learn. Teachers need to consider how students learn to teach effectively. The principles of learning theory allow us to develop higher-order thinking in our students. They allow us to design lessons that anticipate the developmentally appropriate responses of our students. They allow us to think carefully about how our students think so that we can lead them to academic achievement.

Underlying all of these issues, and all that has been discussed in this text, is the fundamental and simple fact that children have important physiological and psychological needs that are prerequisites to successful learning. How can a first-grader who is hungry really focus on phonemic mastery? How can a student who did not sleep the night before really engage and internalize the concept of the Pythagorean theorem? How can a fifth-grader with a sore throat get the most out of her independent reading time?

As we discuss briefly in the *Instructional Planning & Delivery* text, Maslow's hierarchy of needs tells us that intense learning (the kind that translates into closing the achievement gap for our students) first requires the fulfillment of a whole range of basic physiological and psychological needs—needs such as nutrition, sleep, health, and security. While all teachers in all classrooms face challenges related to these student needs at some point or another, in the under-resourced communities and schools where you will be teaching, these basic prerequisites to learning can represent a formidable hurdle for you in your quest for significant academic gains for your students.

You see kids with no shoes, without jackets, sick, with glass in their foot, getting beaten up at home. Those kids are not coming through the door thinking about learning, they are coming to school to get basic needs met. Yes, my role is to teach them and lead them to academic gains, but before any of that happens, we have to bring them to a place to be able to learn. The role of the teacher is to meet all of the basic needs of the student as much as possible, because if you can't, the child can't learn. If it something is outside your locus of control, find the person who has control and do something about it.

Justin May, New Orleans '00
Second Grade Teacher
Addison Northeast Supervisory Union

As you know, for some of our students, the fulfillment of these needs unfortunately cannot always be taken for granted. You will most certainly encounter students for whom some basic physiological or psychological need is interfering with their learning. One of the many profoundly difficult aspects of being a teacher is deciding when and how to address those basic needs so that your students can access the knowledge and skills that you are teaching.

Prerequisites to Learning

With much gratitude to alumnus Dr. Stephen North, NC '93 for his help, we have gathered some basic information about some of the physiological and psychological issues that sometimes inhibit children's learning. We also provide guidance on how to deal with them.

First, we will address some issues that teachers might face with students of any age—malnutrition, sleep deprivation, and illness. As we consider these problems, we will provide specific tips for addressing these problems, both reactively and proactively. Second, we will turn to several health-related issues that are of particular concern for adolescents and their teachers. Again, we will focus on steps that you may take as a teacher to lessen the impact of these problems.

As a chronically tardy student, Herman rarely ate breakfast before school. I could tell when he was hungry because he faded out of lessons. Eventually, I started keeping a "breakfast" drawer where Herman knew he could go get a snack.

Maia Heyck-Merlin, South Louisiana '99
Chief Operating Officer
Achievement First

Finally, we will acknowledge the difficult questions this conversation raises about the role of a teacher in the first place by considering the reflections of several teachers who have considered these questions. In some cases, you may decide to help in the prevention of nutrition, poverty, and health-related problems that impact your students learning. In other cases, you may want or need to react to a situation.

This chapter is aimed at providing a better understanding of how and why basic needs can infringe on learning as well as what your role as teacher should be in difficult situations related to such needs. It will also provide a cheat sheet of the numerous potential common problems that your students may face with information on the prevention techniques, warning signs of problems, and steps or resources for handling each situation. Our hope is that in providing this material, we will both make you more comfortable when and if you encounter any of these situations and better prepare you to achieve significant gains in your classroom.

Teachers at all grade levels encounter students whose potential for academic achievement is jeopardized by the students' poor nutrition, lack of sleep, and/or poor health.

I. Nutrition

Researchers have repeatedly found a direct connection between nutrition and academic performance. For example, one study found that morning fasting has a negative effect on cognitive performance, even among healthy, well-nourished children. A test of the speed and accuracy of response on problem-solving tasks given to children who did or did not eat breakfast found that skipping breakfast had an adverse influence on their performance on the tests.[31] In a recent New York study, many students experienced malnutrition that was too slight for clinical signs yet still affected their intelligence and academic performance.[32] Still another showed that iron deficiency anemia leads to shortened attention

[31] Pollitt, E., Leibel, R., Greenfield, D. "Brief fasting, stress, and cognition in children." *American Journal of Clinical Nutrition* 1991; 34(Aug):1526-1533.
[32] Schoenthaler, S. "Abstracts of early papers on the effects of vitamin-mineral supplementation on IQ and behavior." *Personality and Individual Differences* 1991; 12(4): 343; Schoenthaler, S., Amos, S., Eysenck, H., Peritz, E., and Yudkin, J. "Controlled trial of vitamin mineral supplementation: effects on intelligence and performance.." *Personality and Individual Differences* 1991; 12(4): 361.

span, irritability, fatigue, and difficulty with concentration.[33] Consequently, anemic children tend to do poorly on vocabulary, reading, and other tests.

Moreover, similar studies indicate that even moderate under-nutrition (inadequate or sub-optimal nutrient intake) can have lasting effects and compromise cognitive development and school performance. It is well established that children who suffer from poor nutrition during the brain's formative years score much lower on tests of vocabulary, reading comprehension, arithmetic, and general knowledge.

Incidence of Malnutrition

As new teachers in under-resourced schools quickly discover, the incidence of malnutrition and hunger in this country is astonishingly high. The U.S. Department of Agriculture (USDA) reports that in 2000 10.5 percent of all U.S. households, representing 20 million adults and 13 million children, were "food insecure" because of lack of resources. ("Food insecure households" are those whose members take in enough calories, but have diets of reduced quality that do not meet daily nutritional requirements.) Of the 11 million households that were food insecure, 3.3 million suffered from food insecurity that was so severe that the USDA's very conservative measure classified them as "hungry." Over five-and-a-half million adults and over two-and-half million children lived in these hungry households.[34]

Overall, households with children experience food insecurity at more than double the rate of households without children. Geographically, food insecurity is more common in central city households, areas often also affected by a lack of convenient grocery stores. America's Second Harvest found that their food bank network of emergency food providers served 23 million people in a year (nine percent more than were served in 1997), and more than 9 million of those served were children.[35] You will likely encounter some of these children in your classroom.

I always kept snacks in my classroom and stopped teaching around 10 am every morning for a snack break. Without this, many students, especially those who did not eat or sleep well at home, would not be able to concentrate.

Melissa Storm, Louisiana '94
Senior Research Analyst
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Signs of Malnutrition

There are numerous signs that could lead a teacher to suspect that malnutrition may be a concern. According to the Food Research Action Center (FRAC), hungry children suffer from two to four times as many individual health problems, such as unwanted weight loss, fatigue, headaches, irritability, inability to concentrate and frequent colds, as low-income children whose families do not experience food shortages.[36] Hungry children are less likely to interact with other people (including their peers) or explore or learn from their surroundings. The most obvious sign of hunger may be students' absence, given that hungry children are more likely to be ill and absent from school than their fed peers.

Addressing Malnutrition

While the decision to actually bring food for students is one that many teachers choose not, or cannot afford, to make (see "Teacher's Role" section below), most schools do have breakfast programs. You may find that you need to take extra steps to ensure that your students are accessing the programs, whether that means talking to parents or bringing that food into your classroom each morning. Research showing that eating breakfast increases composite math and reading scores, improves

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[33] Parker, L. *The relationship between nutrition and learning: a school employee's guide to information and action.* Washington: National Education Association, 1989.

[34] Nord, Mark. "Household Food Security in the United States, 2001." Economic Research Service (ERS) Food Assistance and Nutrition Research Report No. FANRR29. October 2002.

[35] http://feedingamerica.org/, accessed 7/1/2010.

[36] http://www.frac.org/html/hunger_in_the_us/health.html, accessed 7/1/2010.

student behavior, reduces morning trips to the nurse, and increases student attendance and test scores only underscores the need for teachers to take positive steps to help ensure their students are well fed.

Proactively—especially in the elementary grades—you may have opportunities to infuse nutrition-related messages into your lessons. Whenever possible, you should share the importance of good nutrition, making connections between nutrition and the academic goals in which you have invested your students. Beyond the numerous resources that your school may already have on nutrition education (ask your administrator), our Toolkit contains a few useful documents and ideas to help guide your nutrition lessons. For a number of nutrition-, health-, and fitness-related internet resources look in the **Learning Theory Toolkit** (pp. 9-11), which can be found online at the Resource Exchange on TFANet. 🛠

At the time, Atlanta had restricted recess for its students, so I had to find ways for my 3rd graders to get their energy out in other ways. We often completed our math problems, for example, using musical math. I posted the problems around the room, and students rotated to a different problem when they heard the music go off. These kind of activities can easily get out of control if they are not VERY structured and if you have not taught your students the specific behaviors you are looking for!

David Jernigan, Atlanta '00
Executive Director
KIPP Schools

While the opportunities may be fewer, nutrition should also be emphasized with secondary students. You may want to integrate nutrition lessons into courses like biology or health. The US Department of Agriculture's website includes a number of lesson plans that may be useful for secondary students.[37] Students can do research projects on nutrition (or malnutrition) and what it takes to eat well.

II. Physical Fitness

Physical fitness is also a real concern for teachers who want to help their students succeed academically. Recent studies show that providing more opportunity for increased physical activity leads to increased test scores even if that requires reduced class time.[38] Another study indicates that aerobic conditioning may help to improve memory. Exercise may strengthen particular areas of the brain, and oxygen intake during exercise may enhance greater connections between neurons.[39]

Incidence and Signs of Lack of Physical Fitness

One doesn't have to be a doctor to recognize when a student is not being physically active, and our schools are giving students less opportunity to stay fit. According to the Centers for Disease Control and Prevention, only 29 percent of students attended daily physical education classes in 1999, compared with 42 percent in 1991.[40] Nearly half of young people between the ages of 12 and 21 do not engage in any physical activity on a regular basis.

Among the signs of a lack of physical fitness are obesity, shortness of breath with minimal exertion, frequent fatigue, and lethargy. Lack of physical fitness is also associated with lower levels of self-

[37] http://fnic.nal.usda.gov

[38] Symons CW, Cinelli B, James TC, Groff P. "Bridging student health risks and academic achievement through comprehensive school health programs." *Journal of School Health* 1997, p. 220-227; Dwyer T, Sallis JF, Blizzard L, et al. "Relation of academic performance to physical activity and fitness in children," *Pediatric Exercise Science* 2001, pp. 225-237.

[39] Action for Healthy Kids. "Fact Sheet: Nutrition, Physical Activity and Achievement." http://www.actionforhealthykids.org, accessed 7/1/2010.

[40] Centers for Disease Control and Prevention. "School Health Policies and Programs Study 2000." *Journal of School Health*: Vol. 71 No. 7, September 2001. http://www.cdc.gov/nccdphp/dash/shpps/, accessed 7/1/2010.

esteem and higher levels of anxiety and stress. And, although it has been well documented that being overweight increases the risk for cardiovascular disease and premature death, it has only recently been shown that overweight children achieve lower scores in standardized achievement tests.

Addressing a Lack of Physical Fitness

While you can't make your students go for a three-mile run every day, or watch over what they eat for dinner, you can take some steps to help your students understand the benefits of physical fitness. By teaching nutrition (see "Nutrition" section above), explaining the dangers of obesity, and highlighting the benefits of exercise, you can have a significant impact on your students' understanding of this health problem. Beyond directly teaching this information, you can avoid the use of junk food as an incentive in your other classroom lessons. In addition, encouraging physical activity through classroom activity, and even making it a reward for success can put exercise in a more positive light for your students. Cliff Berlow, Chicago '02, for example, started a sports program at this school that includes boys' and girls' basketball.

One objection to recess has been that kids are more disruptive after recess than before. This has resulted in limiting recess time, especially over the lunch hour. Several schools are experimenting with Recess First lunch periods in which the students play outside and then return to the cafeteria to have lunch. This has two effects: lunch becomes a calming transition period, and the pressure to hurry through meals to get the best swing or get on the kickball team is eliminated.

The Problem of Obesity

One potential manifestation of a lack of physical fitness is obesity, a condition also associated with nutritional problems. While malnutrition often results from a lack of food, it can also arise from overeating the wrong types of food.

Malnourishment and lack of physical exercise may therefore manifest itself in obesity. The American Obesity Association recently found that about 15.5 percent of adolescents (ages 12 to 19) and 15.3 percent of children (ages 6 to 11) are obese. The increase in obesity among American youth over the past two decades is at least two-fold. Elementary school students who are obese have a 50% chance of being obese as adults. High school students have a 75% chance of being obese as adults.

The complications of obesity and a lack of physical fitness are even more serious than poor body-image, exhaustion, social stigmatization and discrimination in academics and employment. They can include serious health issues like high blood pressure, heart disease, type II diabetes (even for children and adolescents), high cholesterol, and orthopedic problems. Most people, especially students who are constantly bombarded with junk food advertising, do not realize the gravity of obesity and inactivity in terms of these stark health ramifications.

Consider banning junk food from your classroom. Justin May, New Orleans '00, kept a small supply of healthy snack alternatives in his classroom, and he encouraged his students to "trade up" from junk food to one of his nutritional snacks. By sending strategic messages about nutrition, he found that his students were always interested in trading potato chips for some apple slices.

You should also do what you can to be a good model for your students. Many new teachers serve as coaches at their schools and encourage their students to join teams. You can also talk matter-of-factly with your students about your attempts to maintain a healthy lifestyle. By showing an interest in physical activity (whether as a coach or watching school games), you are modeling the virtues of exercise.

III. Sleep

The National Heart, Lung, and Blood Institute (NHLBI) state that children need at least nine hours of sleep per night. For a whole host of reasons, some of your students may not get the sleep they need to stay alert in your classroom. Younger children may sleep in a room with siblings that keep them up, may not have much parental supervision, or may simply not have a comfortable place to sleep. Older students

might be in any of those situations, or might have evening and nighttime jobs that interfere with sleep. Schoolwork itself might be keeping students awake at night, especially when it is put on top of a full load of extra-curricular activities. In other cases, single parents or both parents may be working nights, giving older children some nighttime parenting duties.

Moreover, as we all know, a lack of sleep—especially for young children—can lead to irritability, decreased focus, easy frustration, and difficulty controlling impulses and emotions. School performance usually suffers and behavior is likely to worsen. Sleep, nutrition, and exercise are part of the foundation of a healthy childhood and for academic success.

Adolescents experience similar problems from a lack of sleep, and are probably more likely to carry sleep deficits. Adolescence is a time of important physical, cognitive, emotional and social change when behaviors in one developmental stage are constantly challenged by new abilities, insights, and expectations of the next stage. Sleep is a crucial aspect of adolescent development and is particularly essential during these years. Despite the fact that the need for sleep increases during adolescence, the typical adolescent drastically reduces the time spent in bed at night. By age 16, students are sleeping fewer than 7.5-8 hours per night.[41] Studies have shown that more total sleep, earlier bedtimes, and later weekday rise times are associated with less daytime fatigue, an increased ability to concentrate, less tendency to doze off in class, a less depressed mood, and better grades in school. [The website "Inside the Teenage Brain" provides a good overview of brain development in adolescents.[42]]

Having experienced most of them ourselves, most of the signs of sleep deprivation are relatively obvious—most obvious of all being the fact that a student is really sleepy all the time. Other indicators include increased irritability, weariness, poor attention span, decreased initiative, and decreased motivation - especially for mechanical, inactive tasks and those that require sustained concentration. Memory lapses may also occur. Some students lose their judgment and decision- making abilities. Others may get frequent headaches.

You can affect a student's sleep patterns. First, as a role model, you should emphasize the importance of sleep and encourage students to sleep more, especially before tests to enhance performance. If you notice signs of sleep deprivation in your students, ask them about their sleep habits and help them understand why sleep matters for their health, mood, and academic success. You may want to send a general flyer about sleep and nutrition home to parents. Also, while visiting your students' homes, you may want to see where your students sleep to make it easier to discuss their sleep habits with them and why sleeping well and enough is essential to their health and academic success. Encourage parents to keep televisions out of children's rooms. As with nutrition, physical fitness, and general health, you can have a significant influence on your students simply by consistently emphasizing the importance of sleep to your class's academic goals.

IV. Health

Students' health can be a daunting and overwhelming issue for teachers in the classroom. Especially with younger children, runny noses, upset stomachs, lice, ringworm, pink-eye, and chicken pox are relatively common occurrences. Even with older students, teachers have to become adept at navigating the many minor health issues that spring up and at spotting indicators of serious problems.

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[41] National Commission on Sleep Disorders Research. "Wake Up America: A National Sleep Alert." Government Printing Office: Washington, DC, 1993.

[42] http://www.pbs.org/wgbh/pages/frontline/shows/teenbrain/, accessed 7/1/2010.

Of course, you should certainly consult with a health professional if you have any suspicion that serious health problems are arising. Most often, however, you will be witness to a whole range of "minor" health issues—any one of which can dramatically inhibit students' academic progress.

Dr. Stephen North, NC '93, a doctor in Rochester, New York who focuses on school-based health care, assisted us to gather some basic information on the causes, signs, and impact of many of those health issues. To read the tips for teachers who are confronted with those health issues, see the **Learning Theory Toolkit** (pp. 12-16: "Common Student Health Issues: Causes, Signs, Impact"). Also provided in the Toolkit is a "Viral Prescription" (pp. 17-18) that gives basic information about colds and the flu. 🛠

Addressing Health Concerns

Children often express feelings of frustration, family strife, or emotional distress as physical illness. Symptoms can vary, but for the most part, they are expressed as stomachaches and headaches. If you have any doubt, however, that a condition may be serious, always err on the side of caution and seek a professional's diagnosis through the school nurse. Keep in mind that you see your students as much as their parents and infinitely more than their physicians, and you therefore may be one of the most likely adults to observe rapid or gradual changes in physical appearance, mood, and attitude that might be signs of health problems.

Your school nurse will also be an excellent resource for gaining understanding about what conditions and diseases are prevalent in your school, and as you learn more about your students and their families you will begin to develop a better understanding of what influences their health. For example, teachers learn that children with significant stressors in their families have a 40% greater chance of developing illnesses like strep throat.

Many of my pre-K students had significant health issues, and had to spend a lot of time either at home or in the hospital. Physically, they were getting the care that they needed; academically, they would inevitably slip behind. Some of my students were actually able to complete work in the hospital; I would often bring them tracing worksheets and books from the school library related to the current thematic unit. I maintained contact with the parents throughout the absence to keep them updated on what we were studying, and suggested ways that they could work with their child. One of my students received homebound care, and so I spent about two hours a week preparing lessons and working with the homebound teacher to ensure continuity between the classroom and the instruction he received at home. It's difficult, though, to demand the same of a child who has severe health issues as you would of a child without them.

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Doctoral Candidate
Harvard University

While determining why a student is sick may not be your role, by being aware of the environments in which your students live you will get a better understanding of the risk factors they face. Asthma is one of the leading causes of school absences and children's visits to the hospital, and according to Dr. Jean Hanley-Lopez of Los Angeles County + University of Southern California (USC) Medical Center, the illness is disproportionately prevalent among children in high-poverty urban environments, with cockroaches, mice and leaky roofs as potential triggers. [43] University of Maryland Medicine reports that up to 20 percent of Baltimore City children are asthmatic, as opposed to the national average of seven percent. [44] To combat this problem, Los Angeles, Baltimore and several other major cities now boast fleets of "Breathmobiles," customized motor homes that visit schools and provide diagnosis, treatment and medication for children and families at no charge. Staff members aboard the Breathmobiles aim to educate the public about the causes of asthma and show children how to control the illness and take

[43] http://www.4children.org/news/7-97asth.htm
[44] http://www.umm.edu/news/releases/breathmobile.htm, accessed 7/1/2010.

medication regularly. The professionals also explain the value of bedding encasings, which can significantly reduce the number of dust mites living in the fibers of quilts and mattresses.

Another one of the greatest risks to students' health and long term learning potential is lead poisoning. Typically this is found in older housing stock in urban and rural areas. Lead-based paint used on areas with high friction (e.g., window jambs) flakes off and releases lead into the environment, which ends up being ingested. Recent research demonstrates that even low lead levels can result in a decrease in IQ over a long period of exposure.

More proactively, all teachers can address health concerns by emphasizing nutrition and physical fitness with their students. Teachers can reinforce the importance of and diminish the fear of going to the doctor. Elementary teachers in particular should model and teach good hygiene. Children should be taught and reminded to wash their hands, use tissue paper for runny noses, etc. Some teachers, for example, have toothbrushes labeled and ready for students after lunch.

Teachers may also be the first adult to recognize signs of mental health issues in a student. Depression and anxiety are the two most common mental health issues faced by children in the United States. Two to five percent of grade school students and as many as 8.3% of adolescents suffer from depression.

Recognizing depression in children and adolescents is difficult because it does not always present with the same signs and symptoms as adult depression. Instead of being withdrawn and sad, adolescents with depression are often irritable, anxious, and or angry. They also have an increased rate of other serious problems such as anxiety, substance abuse and disruptive behavior. Other common signs of depression include drastic changes in peer groups, increases in incomplete assignments, and changes in eating habits.

Reporting Child Abuse

As a teacher, you are required by law to report all suspected child abuse and neglect cases (as are police officers, physicians and registered nurses). Physical indicators of child abuse may include unexplained bruises or welts that suggest the use of an instrument, unexplained burns, torn or bloody clothing, and difficulty sitting or walking. You must report not only your suspicions, but also any statements from a parent, guardian, custodian or other person legally responsible for the child that, if correct, would indicate that he or she had been abused.

If you suspect child abuse and you don't report it, you may be subject to disciplinary action by your school district; civil liability for all damages inflicted upon or suffered by the child and caused by your failure to report; and criminal charges punishable by jail time and or a fine.

For more information, explore some of the following websites:

http://child-abuse.com/
http://www.ndacan.cornell.edu/
http://www.childhelpusa.org/

V. Health Issues for Adolescents

Of course, all of the concerns discussed thus far—malnutrition, lack of physical fitness, sleep deprivation, mental and physical health—apply to elementary and secondary students alike. Adolescents' academic success is equally compromised by hunger, headaches, and sleepiness. Complicating matters, adolescents often do not like to seek attention for their medical problems for a variety of reasons. They may view a doctor's office as something for little kids, they may be experiencing embarrassment about the physical changes of puberty, or they may have encountered physicians who simply did not relate well to them.

At the same time, adolescents are uniquely susceptible to a number of health related concerns, all of which can raise obstacles to your teaching and their learning. Unfortunately, drugs, teen violence, smoking, unplanned pregnancies, and eating disorders are just a few of the real risks that young adults face. If you are teaching these students, you will no doubt share their concern about these risks. As their teacher and leader, you are in a unique position to influence their decisions and should take full advantage of that opportunity. You might consider journal or other writing assignments to explore with your students the long-term risks of drug use. You might use historical lessons about inspiring individuals to push students to think beyond the immediate time-horizon about their own lives and futures. You might use a unit on persuasive language to deconstruct the subtle and not-so-subtle messages that advertising sends us and how those message might affect people's body image. Two excellent resources for information about adolescent health are the National Institute of Health's Teen web site[45] and TeensHealth.[46]

Your Health
Teaching is demanding work. Many teachers, probably because of combination of exposure to many sick kids and the intense workload, find themselves having to make a special effort to take care of themselves. For some ideas about how to do that, see the **Learning Theory Toolkit** (pp. 19-21: "Teachers' Stress Busters"); this Toolkit can be found online at the Resource Exchange on TFANet. 🛠

VI. Homelessness

Nearly one million children in America are currently homeless.[47] The causes are deep and varied, but national organizations frequently cite declining wages, the lack of affordable housing and the decrease in public assistance as major contributing factors. In every state, metropolitan area, county and town in the U.S., more than the minimum wage is required to afford a one- or two-bedroom apartment at fair market rent, according to the National Low Income Housing Coalition.[48]

School-age children who are homeless face many barriers to attending school, such as missing necessary paperwork or immunization records, failing to meet residency requirements, and lacking transportation, adequate clothing and supplies. Homelessness often breaks up families; shelter policies sometimes deny access to older boys or fathers, or parents may place their child into the care of a friend or relative. Students may feel abandoned or despondent. According to the Massachusetts Department of Education, it may take four to six months for a child who is homeless to get acclimated to a new school. Researchers James Stronge and Karen Hudson offer a child's point of view:

> Try to imagine the trauma of being homeless. You may be sleeping in a car or living in one temporary shelter after the next. Perhaps you simply do not know *where* you are going to sleep. If you are homeless, it would likely mean moving to strange cities or neighborhoods, not knowing your neighbors, and losing track of friends and family. It would mean becoming rootless, and if you were school age, explaining to classmates why they can't come over to your house to play.[49]

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[45] http://www.nlm.nih.gov/medlineplus/teenhealth.html, accessed 7/1/2010.
[46] http://www.teenshealth.org, accessed 7/1/2010.
[47] "A New Look at Homelessness in America," Urban Institute, 2000.
[48] "Why Are People Homeless?" National Coalition Fact Sheet #1, National Coalition for the Homeless, September 2002.
[49] Stronge, James H., and Hudson, Karen. "Educating Homeless Children and Youth with Dignity and Care." *Journal for a Just & Caring Education* 5 (1999): 8.

Prerequisites to Learning

Of course, there is no one "homeless child." The federal definition of homelessness not only includes children sleeping in a shelter, a car, or a park, but also those awaiting foster care placement, temporarily living with friends of the family due to loss of housing or economic hardship, staying in a motel, and other transient arrangements. The public – and, potentially, school personnel – often are unaware of the diversity of circumstances among the homeless, an ignorance that can curb access to the care that children need.

The McKinley-Vento Act, reauthorized in January 2002, requires school districts to keep children who are homeless in their school of origin (to the extent feasible) unless a parent or guardian authorizes otherwise. This means that students who become homeless and move outside the district's limits may still be eligible to attend their original school, and the Act further mandates for transportation to be provided. If you have a student in your class who is homeless, you can help him or her fill out appropriate forms by making yourself aware of McKinley-Vento, as well as the policies mandated by your State Coordinator for the Education of Homeless Children and Youth. For websites that help you identify resources for children who are homeless in your community, see the **Learning Theory Toolkit** (p. 22), which can be found online at the Resource Exchange on TFANet. 🛠 Every school district is required to have a liaison for students who are homeless.

In addition, McKinley-Vento requires school districts to enroll students who are homeless and new to the area, even if these children do not have required documents, such as medical records or proof of residency. You can reassure students or parents who are forced to move far away because of homelessness that they are legally entitled to immediate access to education in their new district.

Beyond being familiar with your students' rights and with community resources, educators recommend in-classroom strategies to help students who are homeless overcome the obstacles to their success:

- **Think through the supplies you require students to use.** Students may not be able to obtain the materials necessary to make that volcano for earth science class, or have the space in which to store it. Secure supplies and give plenty of lead-time on complicated assignments so students have time to work on the project in your classroom after school, if necessary. Arrange assignments so students don't have to keep things at home, and when planning projects that involve the television or a computer, have alternative options or a way for all children to access that technology at school.

- **Tend to emotional needs.** Children who are homeless are in particular need of affirmation, belonging and an outlet for sharing their feelings. Get students involved in the running of the classroom as soon as possible by assigning responsibilities, such as serving as an attendance monitor or another type of assistant. Build social networks among students by creating cooperative groups, where appropriate, and provide safe opportunities for students to express their emotions and to solve problems.

- **Create peer awareness.** Curtail potential misconceptions and stigmas by educating your class about homelessness through social studies lessons or the use of literature. Eve Bunting's *Fly Away Home* (grades 1-3), Jerry Spinelli's *Maniac Magee* (grades 4-7) and Gary Paulsen's *The Crossing* (grades 8-12) are recommended reading.

- **Be persistent and build persistence.** In the research about building resilience in children, successful teachers involve students in decision-making, use students' strengths and dreams as starting points to build motivation and emphasize to students that adversity is not permanent. They also find ways to

keep students in school. Keep track of attendance, and let returning students know that you missed them in their absence. Collaboratively brainstorm ways that can enable them to get to school regularly. Resilient children often credit their success to an adult that took a special interest in them. The National Coalition for the Homeless notes that education is the key to ending the cycle of homelessness. Caring, committed teachers can play a vital role in this process.

Conclusion and Key Concepts

Although a teacher is not necessarily responsible for his or her students' health, a teacher is responsible for student learning. Sometimes, you will find factors in your students' lives which impact their ability to learn and you—as a teacher concerned with your students' achievement—must help find solutions to those problems that are in the way of your students' success. To paraphrase Justin May, a 2000 New Orleans corps member who led his students to significant academic gains—

> *If a student needs a jacket, it is within your control to go to lost and found and find him one. If your student oversleeps, it is within your control to call him to wake him up. If a student has bad breath, don't complain to other teachers about it—get a toothbrush and put the student's name on it and help him use it at school. If a student can't see well, help his parents find a clinic to get an eye exam. There's a lot that's within your locus of control.*