# Introduction

## Thinking: Levels, Purposes, and Contexts

Thinking skills are the most basic of all the skills that can be developed in the classroom and are the foundations of high achievement for all learners. Students learn to think effectively when they have many opportunities to think at different levels, for different purposes, and in different contexts as an integral part of their learning. From kindergarten through grade 12, they need daily challenges that develop, refine, and extend their thinking capacities while they acquire knowledge and build skills. This introduction elaborates on this viewpoint and provides a context for the instructional strategies presented in the chapters that follow: thinking strategies for student achievement. The context includes perspectives on thinking along with basic principles of learning that lead to engagement and high achievement.

### Thinking at Different Levels

Cognitive psychologists and educators have consistently recognized that some kinds of thinking are of a higher order than others. For example, Vygotsky (1962, 1978) pointed out that we are born with the most basic cognitive functions but develop higher mental abilities, such as abstract reasoning, as we mature. He stressed that cognition is heavily influenced by the culture within which we are raised, the way we are socialized as we develop, and the different kinds of interactions we have with others. His emphasis on the importance of the sociocultural aspects of learning and cognition set the stage for a later interest in cooperative learning and other forms of student-to-student

interaction that help to develop high-level thinking abilities in social contexts (Lyman, 1981; Kagan, 1994; Singham, 1998; Jensen, 1998, 2005).

Benjamin Bloom was another proponent of the concept of levels of thinking. He and his colleagues identified six levels and presented them in a taxonomy of educational objectives (i.e., cognitive actions in which students should engage; Bloom Englehart, Furst, Hill, & Krathwohl, 1956). Bloom's levels of thinking are listed here from lowest to highest in terms of complexity with examples of how each level of thinking might be manifested in action.

**Bloom's Taxonomy of Educational Objectives (1956)**

| *Level of Thinking* | *Examples of Actions* |
|---|---|
| Knowledge | list, recognize, recall, define, repeat, memorize, label |
| Comprehension | explain, describe, categorize, restate, translate, infer, discuss |
| Application | illustrate, demonstrate, interpret, solve, use in a new context |
| Analysis | compare/contrast, examine, test, inquire, infer, diagram, differentiate, prioritize |
| Synthesis | design, construct, organize, formulate, integrate, predict, modify, formulate |
| Evaluation | judge, criticize, argue, defend, persuade, reframe, consider from a particular perspective |

Later researchers revised the taxonomy, as shown on the following page, to suit current educational needs (Anderson et al., 2001). The reversal of the last two original levels reflects a belief that the creative thinking involved in synthesizing information and generating something new is at a higher level of complexity than is the critical thinking involved in critiquing and evaluating.

Jerome Bruner (1960) also suggested that learning involves at least three levels of cognitive activity: acquisition, transformation, and evaluation. From his perspective, effective learners assimilate information by reading, listening, viewing, or a combination of inputs. Then they work with the information, analyzing, connecting, applying, and in other ways putting it to some relevant use that

**Bloom's Taxonomy of Educational Objectives Revised (2001)**

| *Level of Thinking* | *Examples of Actions* |
|---|---|
| Remembering | recall, recognize, identify |
| Understanding | explain, summarize, infer, categorize, compare |
| Applying | implement, execute, solve, demonstrate, use in novel context |
| Analyzing | detect patterns, understand relationships, organize into a structure |
| Evaluating | use criteria or standards to judge, critique, assess, consider from another perspective |
| Creating | generate, invent, produce, reorganize into new system |

extends beyond mere acquisition. Finally, they evaluate the extent to which their transformations have resulted in correct analyses, connections, and applications. Bruner also stressed the importance of intuitive thinking as an adjunct to analytical thinking, both of which he presented as examples of higher-level cognition.

The framework known as Dimensions of Learning (DOL) also makes use of the concept of levels of thinking (Marzano et al., 1992). Dimensions 2, 3, and 4 represent increasingly higher levels of thought, whereas affective elements are contained in Dimension 1 and mental habits in Dimension 5. On the following page is the DOL framework with selected examples of how each dimension might be represented in action.

For many years, teachers have used the concept of levels of thinking in deciding on questions, prompts, and assignments to enhance students' thinking and learning. For example, the DOL framework was introduced with many specific suggestions for classroom applications (Marzano et al., 1992), and Pohl (2000) suggests ways in which Bloom's taxonomy can be used to plan engaging classroom activities with a focus on high-level thinking. Jensen (1998, 2005) stresses that cognitive challenge is a critical feature of instruction that helps students function successfully as thinkers and learners.

Other psychologists and educators have concentrated on analyzing different aspects of high-level thinking. For example, Williams (1970, 1993) investigated the interaction between cognitive and affective responses to information and experience. The high-level cognitive

**Dimensions of Learning**

| *Dimension* | *Examples of Actions* |
|---|---|
| Positive Attitudes and Perceptions About Learning | think positively, feel accepted, be confident, feel willing and able to learn |
| Acquiring and Integrating Knowledge | use prior knowledge, represent learning in various ways, organize new learning for comprehension and retention |
| Extending and Refining Knowledge | comparing, classifying, engaging in inductive and deductive thinking, analyzing perspectives, abstracting |
| Using Knowledge Meaningfully | making decisions, investigating, solving problems, inventing |
| Productive Habits of Mind | seeking clarity, being open-minded, engaging in metacognition, persisting |

elements he considers important are fluent thinking, flexible thinking, original thinking, and elaborative thinking, whereas the affective elements are risk taking, complexity, curiosity, imagination. Buzan and Buzan (1993) suggest how to increase one's thinking capacity by making deliberate use of associations and connections to think in new and "radiant" ways by constructing, refining, and extending meanings with Mind Maps. Robinson (1993) advises learners to approach new information with the intention of mastering it, not just memorizing it and forgetting it soon after. He suggests a number of strategies that keep learners actively involved in high-level thinking, for example, detecting the big picture, making predictions, raising substantive questions, determining the relative importance of information, and connecting new information to previous learning. Hyerle (2000) advocates the use of Thinking Maps, and other visual tools, to represent, organize, and facilitate such higher-level thought as comparing and contrasting, analyzing cause-effect relationships, and generating analogies. Paul (1995) and Paul and Elder (2005) focus on critical thinking, stressing behaviors such as questioning, generating and evaluating conclusions, remaining open-minded, and communicating effectively with others, echoing the work of earlier educators, such as Kelley (1947) and Postman and Weingertner (1969), who also stressed that critical thinking in the classroom is essential to

preparing students adequately for life. Moses and Cobb (2001) argue that high-level thinking, especially in mathematics, is as important to the establishment of a just and egalitarian society as was the civil rights movement of the 1960s.

Students who do well in school are readily given opportunities to engage in high-level thought, the assumption being that they have acquired "the basics" and can now engage in critical and creative thinking. In contrast, students who have been less successful are ordinarily given simplified courses of study in which the emphasis is on the lowest levels of cognition, the assumption being either that they are not ready for high-level thinking or that they are not capable of it. However, considerable evidence exists that underachieving students benefit from and respond positively to more challenging tasks that require higher levels of thinking. Rose (1989) describes how easily students with a history of failure can begin to think of themselves as incapable of academic success but also how, with the right kind of support, they can perform at the highest levels. Cooper (2004) and Jackson (2005) confirm this perspective, synthesizing the research on underachievement and drawing on their own successful experience with students of color in urban schools. Knapp (1995) reports on the demonstrated value of meaning-based instructional approaches that engage students in high-level thinking, while Pogrow (1990, 2000) argues that explicit instruction in higher-order thinking skills is essential as students move from the primary grades into the intermediate grades, especially for those who are faltering academically. Nystrand and colleagues (Nystrand, Gamoran, Kachur, & Prendergast, 1997), Allington (2001), and Moses and Cobb (2001) make the same argument for adolescents, demonstrating that when secondary school teachers concentrate on high-level thinking, students respond by elevating the quality and quantity of their thought. Smith and Wilhelm (2002) report that adolescent males with a history of underachievement readily engage in high-level thinking and literate behavior outside of school even while they respond with indifference to most classroom activities. These researchers suggest that the right kinds of modifications to the boys' instructional programs enable them to demonstrate their true potential in school as well as outside of it. Mahiri (1998, 2004) stresses the value of redefining the concepts of literacy and instruction so as to make classroom learning both more cognitively challenging and more interesting and relevant to secondary students. Position papers from major professional organizations make the same points about adolescent learning: the most effective instruction for all students avoids a heavy

emphasis on basic skills instruction in favor of deliberate attention to a variety of high-level thinking activities (Moore, Bean, Birdyshaw, & Rycik, 1999; National Council of Teachers of English, 2004).

At any grade level, teachers invite high-level thinking when they encourage students to bring their own perspectives to a lesson by asking questions such as *What do you think?* and *Why do you think so?* They engage high-level thinking when they devise ways of challenging students to tackle more complex, unfamiliar material in ways that lead to success. They provide opportunities for high-level thinking when they ask students to represent their learning in a variety of creative forms. Effective teachers actively seek ways of making high-level thinking a regular part of their students' classroom work.

## Thinking for Different Purposes

Besides thinking at different levels, students need to think for a variety of purposes to develop their cognitive capacities fully. To illustrate, here are representative classroom activities, each of which involves a different purpose for thinking:

Figure out an unknown word when reading

Identify the topic of an informational account

State the main idea and supporting details of an informational account

Determine the theme(s) of a fictional narrative or dramatic presentation

Recall information from heard, read, or viewed material

Develop a concept by identifying attributes, examples, and non-examples

Combine information from different sources to draw conclusions

Interpret the meanings of symbols

Detect patterns in sequences of pictures, words, or numbers

Use information to make predictions or form hypotheses

Perceive relationships (e.g., analogical, mathematical, cause-effect)

Organize information into time lines, charts, or other visual displays

Paraphrase information or an explanation

Categorize words, information, or ideas in various ways

Represent information in a new way (e.g., represent a narrative in music)

Summarize an account or a story

Compare and contrast two objects, places, people, or perspectives

Analyze a written or spoken presentation for bias

Distinguish between fact and opinion

Use a rubric to evaluate a response or product

Notice the way ideas are organized (e.g., chronological, categorical)

Visualize a scene or a process

Infer character traits in narrative or dramatic pieces

Critique a point of view or an opinion

Judge the quality of a presentation such as a story, a video, or a speech

Synthesize information from multiple sources into a coherent whole

Judge the expertise of an author or presenter

Brainstorm a wide range of responses

Generate fruitful questions to guide an inquiry

See the big picture into which specific information fits

Appraise the validity and completeness of a source of information

Organize a random array into an orderly arrangement

Use specifics to construct a generalization

Connect what is learned on one occasion to what was learned on another

Weigh various alternative actions in order to select the most appropriate

The stated purpose of the task may not clearly convey the level of thinking required. For example, a categorizing task can involve sorting concrete objects on the basis of such easily detected attributes as color or size, or it can involve a more sophisticated classification system in which more than one arrangement is possible. Similarly,

comparing and contrasting, detecting analogies, or discerning cause–effect relationships are easier with simple, highly familiar material and more challenging with more complex, less familiar material. The key to increasing thinking capacity is to vary the purposes for thinking in ways that are appropriately challenging, given the age of the students, their familiarity with the topic, and their experience with the kind of thinking they are being asked to do.

By identifying and articulating the cognitive purpose of a classroom task as well as the content to be taught, teachers can help all students become familiar with and use a wide variety of thinking processes. By deliberately varying the cognitive purposes from day to day and unit to unit, teachers can continue to increase students' thinking capacities while making them more aware of the thinking of which they are capable.

Most high-level thinking activities can be accomplished by students working alone, but individual work is ordinarily not as desirable as collaborative work. Effective teachers through the years have found that students' thinking and achievement are elevated and improved when they talk and work together about what they are learning, pooling their knowledge and sharing their perspectives (Britton, 1970; Torbe & Medway, 1981; Applebee, 1996; Nystrand et al., 1997; Keene & Zimmerman, 1997; Singham, 1998; Langer, 2002).

## Thinking in Different Contexts

Each unit of study or content area affords a different context within which purposes for thinking and levels of thinking can be varied. To illustrate, here are some examples of sequences of activities in different contexts that suggest how thinking can become the core of an instructional plan. In each example, students are engaged in different purposes for thinking as well as in thinking at different levels:

### Language Arts

In reading and responding to a work of fiction, students might

- recall the sequence of events in the narrative
- infer information about the characters that was not stated explicitly
- connect events in the narrative to events in real life
- compare the story's characters and themes with those of other stories
- visualize a scene from the story and represent it in a drawing

- critically evaluate the quality of the narrative in light of established criteria for such stories
- transform the narrative into a play and act it out

In writing a persuasive essay, students might

- find and summarize information on the target issue
- judge the validity of the sources of information
- form an opinion on the basis of information and personal experience
- organize ideas into an outline or map in preparation for writing
- use a rubric to evaluate the first draft and plan revisions
- provide (receive) response and constructive criticism to (from) peers

## Mathematics

In learning how to compute and work with the area of rectangles, students might

- recall the formula for computing the area of a rectangle
- apply the formula to compute the areas of a variety of rectangles in practice exercises
- compare several rectangles to determine which one has the largest area
- compute the area of various rectangular living spaces in the context of figuring out the least expensive way to cover the floors
- rank a set of rectangular spaces in terms of economy based on how costly they would be to decorate with a specific surface covering
- design a structure according to specifications (e.g., a five-room structure in which the floor area of each room is different but with a total area that does not exceed 1,200 square feet)

In developing understandings of measures of central tendency, students might

- collect information that yields a range of data points
- organize the data points from one extreme to the other
- analyze the data by computing the mean, median, and mode
- represent the mean, median, and mode graphically
- interpret the meanings of the analyzed data
- present the findings in a way that enables peers to understand the three measures of central tendency

## Social Studies

In learning about an era in history, students might

- paraphrase information about the era they find in different sources
- compare and contrast two important people from the era
- represent the chronology of a complex sequence of events from the era in a time line
- analyze the causes and effects of a key event that occurred during the era
- consider the same historical event from several social or cultural perspectives that were relevant at the time of the event
- synthesize information about the era from several sources into a coherent whole

In learning the basics of democracy as a political system, students might

- restate the important elements of democracy as explained in a textbook
- compare a democratic political system with a dictatorship
- categorize various political activities as democratic or dictatorial
- debate the merits of a democracy and of a dictatorship
- analyze various current events in the context of the features of a democracy
- generate questions about aspects of democracy to guide further learning

## Science

In learning about a specific animal, such as an octopus, students might

- observe an octopus firsthand and represent observations in drawing
- form hypotheses about octopus behavior based on firsthand observations
- gather factual information about the octopus to check hypotheses
- compare the octopus with other sea creatures
- synthesize information in a multimedia presentation about the octopus
- take and defend a position on the importance of the octopus to the ecology of the sea

In learning information related to a system of the human body (e.g., the respiratory system), students might:

- summarize information about the respiratory system in their own words
- define and explain key terms associated with the respiratory system
- collect and analyze information that will help them understand the functioning of their own respiratory systems
- represent the functioning of the respiratory system visually and verbally (e.g., in a labeled picture or diagram)
- compare and contrast the newly learned system with a previously learned system (e.g., compare the respiratory system with the circulatory system)
- create a presentation that effectively argues for a specific regimen of eating and physical exercise that would be most beneficial for maintaining the effectiveness of the respiratory system

In each example, although the content is the primary focus of the learning activities, thinking is a vital element before, during, and after learning. Students are not simply taking information in but are organizing, discussing, questioning, analyzing, representing, synthesizing, interpreting, evaluating, and in other ways processing and responding to that information. They are using it in ways that lead to comprehension, retention, and intelligent use of the material.

## Conclusion

Teachers can help all students be successful by using instructional strategies that lead them to think at high levels for different purposes in different contexts. The chapters that follow contain thirty such strategies that can be used across grade levels and content areas. All have been used by classroom teachers in a wide variety of schools, including schools with high percentages of underachieving students; many have been in use for decades. These strategies are powerful because they reflect important principles of learning. Effective teachers understand these principles:

- Students must bring their own perspectives to lessons so that they will see the relevance of the content to their own lives.
- Students must make thoughtful and active use of their prior knowledge in order to learn new information.

- Students need challenges to keep them motivated and engaged in learning.
- Students need opportunities to talk to each other to construct, process, and reflect on meanings while hearing and appreciating one another's points of view.
- Students need to represent their learning in interesting and creative ways that enhance their comprehension and retention.

When teachers honor these principles by using strategies such as those presented here, they will help all students think and achieve at high levels and also derive genuine satisfaction from their experiences as learners.