

Designing **Elementary** **Instruction** and **Assessment**

**Using
the
Cognitive
Domain**

John L. Badgett
Edwin P. Christmann

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Introduction

The instruction and assessment practices of the nation's schools have come under criticism because of their perceived focus on the rote memorization of factual information. We see the acquisition of facts not as an end in itself, however, but as a foundation upon which higher-order teaching and testing can be built. Hence, we use the cognitive hierarchy of Bloom's Taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) to demonstrate how you can guide your students through increasingly complex thinking skills and assess proficiency with multiple forms of assessment at each level. It is important to remember that there is no single form of assessment that is applicable to all performances at each hierarchical level.

The underlying assumption of this book is that instruction for elementary students should proceed in an orderly fashion, from the general to the specific and from the simple to the complex. Just as our content examples serve as models for this progression within the Taxonomy for math, science, social studies, and English-language arts, they also serve as examples for this type of teaching in specialty areas, such as art, music, physical education, modern languages, and technology. You can simply adapt the model to the specialty area.

We advocate a four-step model of planning that entails a logical progression from (1) content area standards to (2) modified standards to (3) unit plan objectives to (4) daily instructional objectives in an understandable sequence of increasing specificity. Moreover, our view of teaching and assessment within each of the content areas is a progression from the Knowledge to the Evaluation levels of Bloom's Taxonomy (Bloom et al., 1956). This sequence is embedded in the interrelationship between instruction and assessment within the curriculum.

While the curriculum is largely driven by state and national standards, many teachers are confounded or even intimidated by the vagueness and lack of detail in the language of the standards. We hope that the easy-to-follow, general-to-specific model proposed in Chapter 1, Deconstructing

the Standards, helps to alleviate these concerns. This chapter shows you how to create clear and precise instructional objectives for various content areas as prescribed by national and state standards. You learn to deconstruct the broad-sweeping goals of the standards and transform them into unit plan objectives (more specific) and daily instructional objectives (most specific). We guide you through modifying the original standards and then designing unit plans around them, which ultimately serve as the basis for your daily instructional objectives. The examples are built around national content area standards, and you can easily adapt the model for use with your own state standards.

Chapters 2 through 7 center on Bloom's Taxonomy (Bloom et al., 1956), a pyramidal structure that proceeds from the simple to the complex, whether we are looking at measurable objectives, paper-and-pencil tests, performance-based assessments, or portfolios. We demonstrate how the teaching of higher-order thought processes is much more effective when proceeding from a baseline level.

Chapter 2 exemplifies how objectives may be written within a cognitive hierarchy that describes simple to complex thought processes that can be applied to any subject area. These daily formative assessments lead to summative assessments through major paper-and-pencil tests (Chapters 3, 4 and 5) and performance-based projects (Chapter 6), which may be appropriately categorized in your students' portfolios (Chapter 7). Just as instructional objectives proceed from the simple to the complex via the Taxonomy, so should the items on paper-and-pencil tests. Hence, the chapters focusing on true-false, completion, multiple-choice, matching, short-answer, and essay items demonstrate how to write these items within appropriate levels of the Taxonomy. You and your students together can place them in their portfolios according to taxonomic level.

We advocate that you organize the contents of your tests in ascending order of difficulty: They should be "steeply graded" (Kubiszyn & Borich, 2007, p. 220), progressing from relatively easy to increasingly difficult items. We recommend this format for several reasons. First, such a format enhances student confidence. If the students first encounter a series of items that they can easily answer, they are more confident when taking on the more difficult items that come later. In addition, they do not become frustrated and fatigued to the point that they miss some of the easier items that they would have answered correctly had they been placed at the beginning of the format. Hence, a simple-to-complex format is recommended in both formative and summative assessment.

Before issuing report cards, we suggest that you and your students categorize representative evidence of their formative and summative performances within their portfolios according to the cognitive hierarchy

(discussed in Chapter 7). A careful review of student artifacts should enhance the quality of your instruction by highlighting the students' strengths as well as their weaknesses.

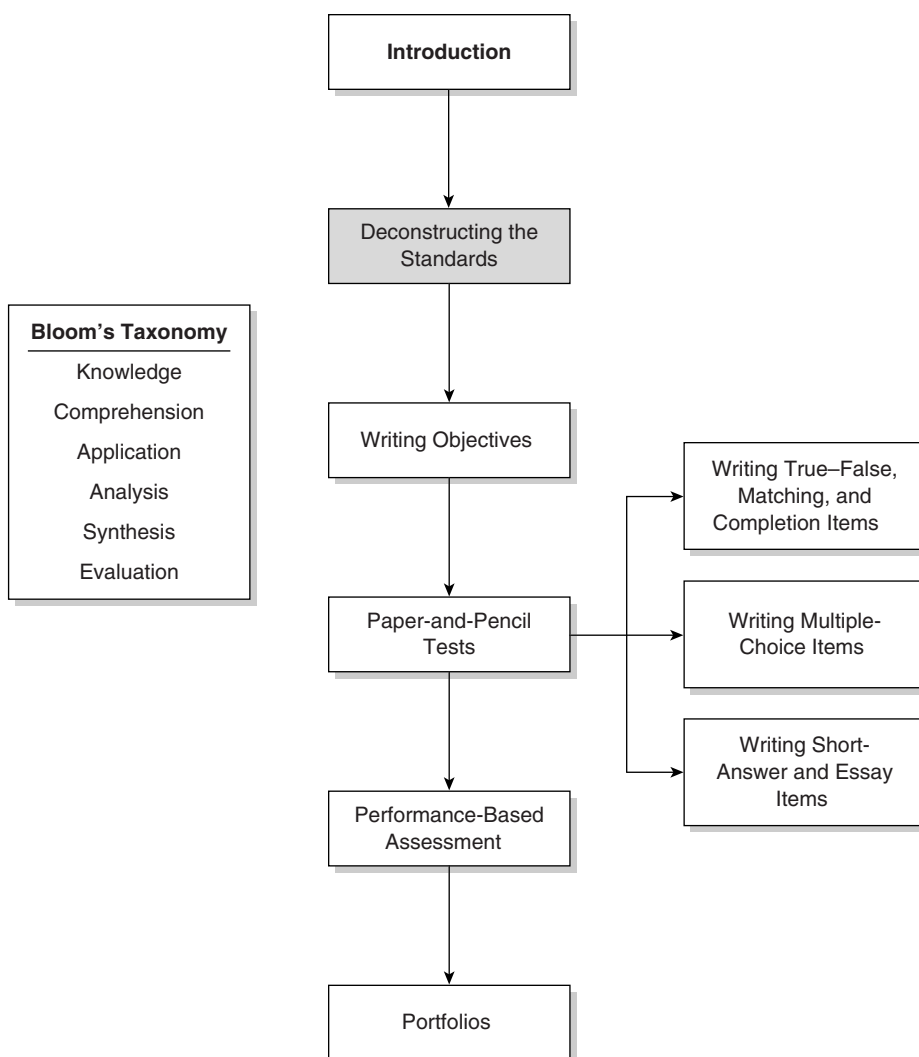
The core of this book is a combination of thorough explanations and abundant examples to guide you through the steps of our model of instruction and assessment that proceeds from a Knowledge-level baseline through the echelons of higher-order thinking processes within the cognitive domain. The daily objectives are the essence of continual, formative assessment and progress from the Knowledge to the Evaluation levels of Bloom's Taxonomy (Bloom et al., 1956). Writing measurable daily instructional objectives for progressive pupil performance through each of the cognitive levels allows you to detect student and instructional strengths, as well as weaknesses, within each level. As conduits of measurable assessment, these objectives provide for the reinforcement of effective teaching strategies, while simultaneously enabling you to ameliorate student weaknesses by reviewing, redirecting, or adjusting current instructional strategies; creating new strategies; or implementing materials that are commensurate with your students' needs.

Ideally, this type of planning and assessment should be supported throughout a school district, beginning with the superintendent and continued by the curriculum director, building principals, teacher leaders, teachers, and paraprofessionals. Such an effort would optimize student learning per se and also maximize student performance on statewide assessments (more about this in Chapter 1).

At the beginning of each chapter, we furnish you with easy-to-follow diagrams that show where we are, where we have been, and where we are going. In addition, to provide you with firsthand involvement with our method, each chapter ends with a section called Professional Development Activities. These activities further your expertise in the design of your personal instruction and assessment practices. They could also be a part of virtually any inservice session.

1

Deconstructing the Standards



Much of the academic curriculum in today's schools is dictated by the respective state standards, which are frequently based on national standards, such as those from the *Principles and Standards for School Mathematics*, the *National Science Education Standards*, the *National Standards for Social Studies Teachers*, and the *Standards for the English Language Arts*. However, it is often difficult to translate these standards into practical classroom implications because of confusion generated by their broad generality and the absence of sufficient direction for their implementation. Hence teachers often have a negative view of standards per se.

Our goal in this chapter is to help you modify the wording of any standard into performance terminology and then transmit it into unit plan and daily instructional objectives, all within a progressive sequence of specificity. This sequence can serve as a set of blueprints for classroom instruction. As you know, most reputable contractors would not consider building a house without blueprints. Of course, changes may occur after construction has begun, but not without accompanying changes in the blueprints, because they provide a basis for ongoing (formative) and conclusive (summative) assessment, and they also enable the contractor to determine whether corrections are in order. Instructional objectives serve the same purpose for classroom instruction.

The litmus test for any instructional objective is whether it provides for objective assessment. Hence, clear language and specific intent should be inherent in every objective at every level. Of course, the level of specificity should increase from national standards to unit plan objectives to daily instructional objectives, and clarity of intent should be vividly present throughout.

Some measurement specialists caution against overadhering to specificity in instructional objectives, fearing that teachers may spend a disproportionate amount of time writing objectives at the expense of preparing for instruction (e.g., Popham, 1995, p. 80). We believe that this is an unwarranted fear.

As we mentioned in the Introduction, virtually all statewide assessment tests are based on state standards, which stem from the national standards. These high-stakes tests are criterion referenced, and aligning your lesson plans with them using our process can certainly enhance your students' performance on these critical examinations: Your comfort in implementing the standards into your instruction and assessment will result in higher student scores.

WRITING INSTRUCTIONAL OBJECTIVES FOR NATIONAL STANDARDS

We begin with sample items drawn from the national standards of the major content areas, break them down to behavioral terms, and transfer them into

unit and finally, daily instructional objectives. This conversion process can be easily applied to the standards of any particular state. We now demonstrate this process for each of the major content areas.

Mathematics

Many of the examples used here are paraphrased or taken directly from the *Principles and Standards for School Mathematics* (National Council of Teachers of Mathematics, 2000). The following example is taken from the Measurement Standard for Grades 3–5, a verbatim portion of the actual standard.

National Standard

Apply appropriate techniques, tools, and formulas to determine measurements. (p. 173)

First, we modify this standard to include an *evidenced understanding* of appropriate techniques, tools, and formulas for determining measurements:

Modified National Standard

Students will evidence an understanding of appropriate techniques, tools, and formulas for determining measurements.

We use the term *evidence* to indicate that students must show that they have met predetermined criteria for fulfilling the standard through observable behaviors. This term is used again in the unit plan objective for continuity and to ensure student performance in determining measurements, through the discovery of means and tools for measuring complex objects.

Unit Plan Objective

Students will evidence an understanding of determining measurements through the discovery of means and tools for measuring complex objects.

As you can see, this unit plan objective includes the original standard while providing for a diversity of means for its fulfillment through daily instructional objectives. The following objective illustrates how a high level of specificity can still include the components of the original standard.

Daily Instructional Objective

Given string and rulers, students will determine how to measure the circumference of a clock to the nearest $\frac{1}{2}$ inch.

This daily instructional objective is specific in terms of materials (string and rulers), behaviors (determine, measure), and minimal standards of performance (to the nearest $\frac{1}{2}$ inch). Through this specificity, it provides a means for addressing the task dictated by the original standard, the modified standard, and unit plan objective.

Remember, this daily instructional objective is but one component within the unit plan that is directed toward the achievement of the national standard.

Science

As with any other discipline taught in Grades K–12, adherence to the respective state standards or National Science Education Standards is imperative for any teacher of science. Let us demonstrate how broad national and state science standards can be stated in specific terms appropriate for unit and daily objectives.

Here is a progression using an actual K–4 standard as prescribed in the K–4 Content F: Science in Personal and Social Perspectives from the National Research Council's (1996) *National Science Education Standards*:

National Standard

As a result of activities in grades K–4, all students should develop understanding of personal health, characteristics and changes in populations, types of resources, changes in environments, science and technology in local challenges. (pp. 139–140)

First, we synthesize this segment into a broad but understandable objective that includes an observable student behavior: to demonstrate.

Modified National Standard

Students will demonstrate an understanding of the relationship between personal health and characteristics and changes in populations; types of resources; and changes in environments, science and technology in local challenges.

We then refine this encompassing objective into terms of more specific student behaviors that can serve as the basis for an entire unit, without

diluting the original standard. This demonstrates again that although more specific than that of the national standard, the language of the unit plan objective maintains an openness that provides for a series of measurable daily instructional objectives.

Unit Plan Objective

Students will display an awareness of safety rules for school and home and exhibit recognition of good nutrition as well as an understanding of the damaging effects of certain substances.

The behaviors *display* and *exhibit* set the tone for the daily instructional objectives that serve as vehicles for implementing the standard within the actual classroom. As we demonstrate by the following example, the teacher can and should use a variety of specific objectives in the classroom for meeting the goal dictated by the national or state standard and clarified by the unit plan.

Daily Instructional Objective

When presented with poster board and Magic Markers, students in groups of two or three will construct posters depicting one of the following topics: good and bad safety habits for home or school, nutritious and non-nutritious foods, or harmful substances and their consequent results.

This daily instructional objective provides a means for meeting the contents of the original standard through the cooperative construction of posters. It also prescribes when the behavior (*construct*) is to take place (“when presented with poster board and Magic Markers”). Since this daily lesson plan calls for creative efforts, the criterion for acceptable performance is simple fulfillment of the assignment. Again, this would be only one in a series of daily objectives designed to meet the national or state standard.

Social Studies

The scholastic area of social studies, as dictated by the *National Standards for Social Studies Teachers, Volume 1* (National Council of Teachers of Social Studies, 1997), encompasses virtually all of the social science disciplines. The following example is taken verbatim from the Geography Standard of the *National Standards for Social Studies Teachers, Volume 1*. First, we will modify this example and then translate it into unit and daily instructional objectives.

National Standard**Geography: Teacher Expectations**

Assist learners to analyze the spatial information about people, places, and environments on Earth's surface.

The inclusion of the term *spatial* makes this national standard more manageable, even though it still provides for a multiplicity of unit and ensuing daily instructional objectives. However, modification is needed to bring the focus onto pupil behavior.

Modified National Standard

Students will demonstrate the ability to analyze spatial information about the Earth's people, places, and environments.

Less confusing than the original standard, this modification focuses on student rather than teacher requirements. Nevertheless, it does allow for great latitude of unit and sequential daily instructional objectives.

Unit Plan Objective

Students will demonstrate an understanding of how the physical environments of southern Mexico and the northeastern United States influence their peoples' respective economic and recreational activities.

As a partial extension of the original standard, this unit plan objective calls for student understanding of how the physical environments of two geographical regions influence specific aspects of their peoples' lives. Much more specific than either the original or the modified standards, this objective still gives the teacher a great deal of freedom in the construction of daily instructional objectives for its fulfillment. The following is one such example.

Daily Instructional Objective

After completing a reading assignment from the textbook, students will list two similarities and two differences between common recreational activities in southern Mexico and the northeastern United States.

Detailed and specific, this daily instructional objective pinpoints when the activity is to take place ("After the completion of a reading assignment

from their textbook”), the particular student behavior (“list”), and the expected outcome (“two similarities and two differences”). Such specificity provides clear understanding for teacher and student.

English–Language Arts

The following example is taken word for word from Standard One of *The Standards for the English Language Arts* (National Council of Teachers of English and International Reading Association, 1996).

National Standard

Students read a wide range of print and non-print texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world. (p. 27)

This standard provides the teacher with unlimited options but virtually no margins of content coverage. The following modified standard adds focus and direction by including possible media sources, mentioned in the discussion following the standard (pp. 27–28), without altering or diluting the original.

Modified National Standard

Students will read novels, newspapers, magazines, and Web-based resources and engage in the study and creation of visual texts to develop their understanding of text *per se*, themselves, and cultures of the United States and the world.

By suggesting general printed sources and recommending the study and creation of visual texts, the modified standard serves as a conduit for the sharpened focus of the unit plan objective.

Unit Plan Objective

Students will engage in cooperative group research projects, directed toward enhancing their understanding of selected cultures within the United States, culminating in class presentations.

Through their involvement in cooperative group research projects, students are directed toward the examination of a variety of printed sources, as mentioned in the original standard and specified in the modified standard. Understandably, the latitude of the original standard

would not be covered in a single unit plan. The following daily instructional objective puts this one into lesson plan terms.

Daily Instructional Objective

In groups of three or four, the students will begin to use the Internet, the school library, and accessible out-of-school sources to research selected cultural groups within the United States, for a composite 15- to 20-minute class presentation containing at least three visuals and a narration.

Quite specific, the language transfers the original standard into a direct but open and measurable outcome. This objective fulfills the intent of the original standard's dictate of the student's building "an understanding of texts" and "cultures of the United States," through its focus and the use of various sources. The standard's dictate for the study and creation of visual texts is accomplished through the requirement of at least three accompanying visuals in the students' narrative presentations.

SUMMARY

In this chapter, we have taken you through the process that can connect and align the national standards, the unit plans, and daily instructional objectives in the major content areas. Like an engineer or an architect, you, the teacher are allowed virtual freedom within predetermined guidelines. Your guidelines are the national or state standards and the ensuing unit plan objectives, and your freedom is in your creative construction and implementation of your daily instructional objectives. Like the engineer and the architect, however, your daily instructional objectives should be specific and measurable.

PROFESSIONAL DEVELOPMENT ACTIVITIES

Make certain that you have copies of the standards for different subject areas (e.g., mathematics, social studies, and English-language arts). Then break into groups of four or five.

Together, select a standard and copy it verbatim. Next, modify it by making it more understandable and student focused. Be sure to include an action verb (e.g., "demonstrate") as a precursor of the description of student performance in your unit and daily instructional objectives. Remember not to change the context of the original standard by deleting from or adding to it.

Keeping in mind that a number of unit plan objectives can stem from a modified standard, cooperatively construct a unit plan objective from any part of your modified standard. Be sure to use at least one action verb and present a general description of what you will expect of your students. You can use the content area samples in the chapter as templates.

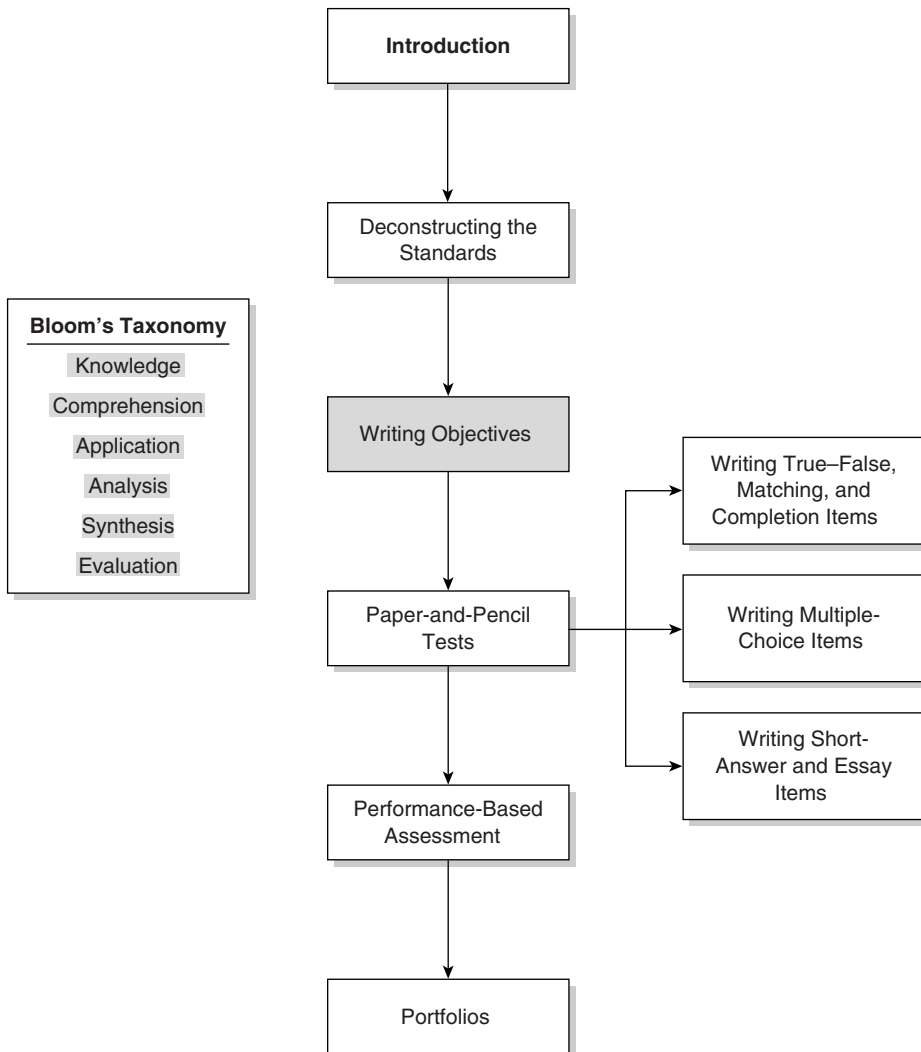
Next, construct a daily instructional objective, selecting a portion of your unit plan objective (always remembering that many daily instructional objectives constitute one unit plan objective).

Be sure to include an action verb depicting observable pupil performance and mention configuration (e.g., in groups of three or four) and context or preparation (e.g., presented with an unlabeled diagram). Also, it is very important to specify exactly what you expect of your students (e.g., with an error margin of plus or minus five miles).

After you have completed this process, each group can put its four components (national standard, modified standard, unit plan objective, and daily instructional objective) on the board or on the overhead for discussion.

2

Writing Unit and Daily Instructional Objectives



As we've demonstrated in Chapter 1, in essence, daily instructional objectives are the measurable means through which the general goals of the state standards and unit plan objectives are accomplished. As we've said, **Unit plan objectives** involve general goals, whereas **daily instructional objectives** are measurable, focused and specific.

When you write unit plan objectives, using terms such as *understanding*, *comprehension*, and so forth is fine, but only when coupled with performance terms (e.g., "demonstrate") or precursors of them (e.g., "evidence"):

The student will *demonstrate* understanding by . . .

The student will *evidence* comprehension of the task by . . .

By including a performance term, the unit plan objective sets the tone for the clear, specific, and measurable dictates of the daily instructional objective. Some authors (e.g., Kubiszyn & Borich, 2003) recommend that these objectives contain three components:

1. An observable student *behavior*
2. The *conditions* under which the behavior is expected to occur
3. *Minimal standards* of acceptable performance

Example: On a worksheet containing ten four-digit addition problems (*conditions*), the student will solve (*behavior*) at least eight of them (*minimal standards*).

Conditions are important components of daily instructional objectives. However, observable student behaviors and minimal standards of performance are virtually indispensable, because they provide the baseline for determining whether the objectives have been achieved.

Unit and daily instructional objectives can be structured for student involvement in activities that span the entire spectrum of any hierarchical model, thus providing a structure for the teaching of higher-order thinking skills. And engaging in higher-order thought processes is essential to maximum student learning.

Bloom's (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) hierarchical model of the cognitive domain is widely used, and because of its relative simplicity and general familiarity, we have employed it as our reference point. Commonly referred to as Bloom's Taxonomy, it is a solid, pyramidal structure that provides for simple-to-complex thought processes within any content area. It is pyramidal in that each level is dependent on the previous levels. A firm knowledge baseline establishes

the solidity of each successive level. Thus ascent through the sequence of higher-order thinking skills becomes a smooth and fluid passage for practically any student within any content area.

Here is a summary of Bloom's Cognitive Domain:

Summary of Bloom's Basic Cognitive Domain

1. KNOWLEDGE:	Recognition and recall of previously learned information; no comprehension or understanding of the information is implied
2. COMPREHENSION	The ability to understand or summarize information, translating information from one form or level to another, predicting continuations in trends of data
3. APPLICATION	The ability to take information that has previously been acquired and comprehended and use it in concrete situations
4. ANALYSIS	The ability to break down a unified whole into its basic parts and understand the relationship among these parts, determining cause-and-effect relationships, understanding analogies and metaphor, determining classifications
5. SYNTHESIS	The assemblage of parts into a new whole, the formulation of a new hypothesis or plan of action, constructing a solution to an unfamiliar problem
6. EVALUATION	The ability to judge a phenomenon on the basis of predetermined criteria or internal consistency

To show the progression through the Taxonomy, we take the words from a vocabulary test and demonstrate how they can be used to determine performance within each of the six levels of this cognitive hierarchy. (Such a progression can be used with any content area, as we've mentioned.)

Knowledge Level: A ten-item written quiz on which students define each of the words is a Knowledge-level activity because it involves only rote memorization.

Comprehension Level: Students writing any synonyms not talked about in class for each of their vocabulary words is a Comprehension-level activity because they are translating the words' meanings from one form to another.

Application Level: Students correctly using each of their ten vocabulary words in separate written sentences is an Application-level activity because they are taking information that has been acquired or comprehended and using it in a concrete situation.

Analysis Level: Students splitting each of their ten words into syllables on a written exercise is an Analysis-level activity because they are breaking down a unified whole into its basic parts; to do this, they must understand the relationship among the parts.

Synthesis Level: Students correctly using each of their ten words in a creative story is a Synthesis-level activity because they are assembling parts into a new whole.

Evaluation Level: Students writing three reasons why they thought a particular assignment was or was not worthwhile is an Evaluation-level activity because they are making value judgments on the basis of personal, experiential criteria.

CONTENT AREAS AND COGNITIVE DOMAIN LEVELS

Mathematics

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Both the unit and the daily instructional objectives should indicate that at this level, the students are expected only to demonstrate the ability to recall previously learned information. For example, since student knowledge of multiplication facts is the basis for many higher-order mathematics processes, these are usually introduced during the middle elementary grades.

Unit Plan Instructional Objective

Example: The student will demonstrate knowledge of multiplication facts.

In using the terms *knowledge* and *facts*, this unit plan objective indicates that student performance is to occur at the Knowledge level: The students must demonstrate that they can recall previously introduced information. Since this unit plan objective contains the performance term *demonstrates*, it calls for a behavior to be included in the daily instructional objectives.

Daily Instructional Objective

Example: As a classroom assignment, the students will write the multiples of two from zero to ten, with no more than two errors.

This is a Knowledge-level assignment, as seen in its requirement for the rote listing of specific facts. The specified conditions, behavior, and minimal standards eliminate the need for interpretation. The conditions state that it is to be a classroom assignment, the observable behavior is to write, and the minimal standard of measurable performance is that the students are to make no more than two errors on the eleven-item assignment.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Both the unit plan and especially the daily instructional objectives at this level should call for the students to demonstrate their ability to summarize information, translate information from one form or level to another, or predict continuations in data trends. Our example deals with developing students' ability to perceive number patterns.

Unit Plan Instructional Objective

Example: The students will show an understanding of number patterns.

The terms *understanding* and *show* are indicative of Comprehension-level pupil performance: Understanding is synonymous with comprehension, and "show" foretells the necessary observable pupil performance in the daily instructional objective.

Daily Instructional Objective

Example: When presented with a worksheet containing five different four-number numerical patterns, the students will write the next two numbers for each pattern.

As we've mentioned, evidencing the ability to continue a data trend is a Comprehension-level activity. In this task, the students are required to complete a number sequence, and the conditions ("When presented with a worksheet . . ."), behavior ("write"), and minimal standards ("the next two numbers for each pattern") are defined.

Application Level: Students have the ability to take information that has previously been acquired and comprehended and use it in concrete situations.

When you have determined that your students are comfortable in their computations of simple addition and subtraction problems, it is appropriate to present them with a series of word problems, thus providing them with opportunities to use previously acquired skills in concrete situations.

Unit Plan Instructional Objective

Example: The students will apply addition and subtraction processes in concrete situations.

The term *apply* marks this as an Application-level objective. “Apply” also connotes the expectation of observable pupil behaviors in the ensuing daily instructional objectives.

Daily Instructional Objective

Example: Given ten word problems involving the addition and subtraction of three-digit numbers, the students will solve at least eight of them.

By applying the acquired skills of addition and subtraction in solving word problems, the students are performing at the Application level. The conditions (“Given ten word problems . . .”), behavior (“solve”), and minimal standards (“at least eight”) are clear and specific.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

You will probably want to show your students that numerical units can be broken down into a multiplicity of interrelated components, which should lead to student understanding of the interrelationships among these different parts. Money could provide meaningful examples.

Unit Plan Instructional Objective

Example: Students will break down numerical wholes into their basic parts.

The unit plan objective points to observable pupil performance in the following daily instructional objective.

Daily Instructional Objective

Example: Presented with an assortment of play coins, the students will demonstrate at least three ways to break down a dollar into nickels, dimes, and quarters.

Understanding the relationships among the components of a unified whole occurs by reassembling that whole, which is the case here as students

break down a dollar into nickels, dimes, and quarters in several ways. The objective is precise in its conditions (“As a written assignment”), the behaviors (“demonstrate” and “break down”) are observable in that they are part of a written assignment, and the minimal standards are definite and quantitative (“at least three ways . . .”).

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Synthesis is a cognitive level that can be achieved by virtually any group of students within any content area. In the following example, we provide students with the opportunity to express what they have learned creatively.

Unit Plan Instructional Objective

Example: Students will demonstrate the ability to create and solve word problems involving numbers.

Creating word problems is a Synthesis-level activity. Also, the terms *demonstrate* and *solve* indicate observable pupil performance.

Daily Instructional Objective

Example: In class, students will design and solve at least two word problems involving multiplication of whole numbers.

With its mandate that the students design and solve their own word problems, this is a Synthesis-level objective. The objective is explicit in its conditions (“in-class assignment,”), behavior (“design” and “solve”), and minimal standards (“at least two word problems”). Also, this objective incorporates the Application level in that the students must solve their problems.

Evaluation Level: Students are able to make value judgments on the basis of predetermined criteria or internal consistency. Since value judgments often involve personal choices, you should assess the students’ rationale for their decisions as opposed to their decisions per se.

At this level, students should be able to make value judgments on the basis of predetermined criteria. Before deciding which technique to apply toward the solution of a given problem, students must determine which technique they prefer and why. You benefit them by providing them with situations where such determinations can be made. As a bonus, the reason they provide for their choices can give you insight into their mathematical strengths and weaknesses.

Unit Plan Instructional Objective

Example: Students will evaluate various techniques for solving given problems.

The term *evaluate* identifies this as an Evaluation-level objective, serving as the prelude to daily instructional objectives that require students to select and justify techniques for solving specific problems.

Daily Instructional Objective

Example: When presented with the option of selecting a technique for determining the number of trees shown on a schematic, with six trees arranged in five rows, students will list three reasons that they selected counting, adding, or multiplying.

This is an Evaluation-level objective in that students are required to select a method for determining the number of trees within the schematic. The students' answers give you insight into their level of understanding. This objective is clear and precise; the conditions are explicit ("when presented with the option . . ."), as are the behavior ("list") and the minimal standards ("three reasons").

Science

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Both the unit and the daily instructional objectives should indicate that at this level, students are expected only to demonstrate the ability to recall previously learned information. As a baseline for making future categorical distinctions, students must know some of the basic characteristics of the various kingdoms, phyla, classes, species, and so forth. It is usually necessary for students to memorize some of the categorical characteristics.

Unit Plan Instructional Objective

Example: The students will demonstrate knowledge of the characteristics of mammals.

The term *knowledge* is open to a variety of interpretations. However, the term *demonstrates* indicates the necessity for observable student performance in the following daily instructional objective.

Daily Instructional Objective

Example: Orally, the students will name correctly at least three characteristics of mammals.

A Knowledge-level objective, the conditions, behavior, and minimal standards are clear and specific: “Orally” (conditions), “name” (behavior), “correctly at least three” (minimal standards of acceptable performance).

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

The unit plan objectives at this level and especially the daily instructional objectives should call for students to demonstrate their ability to summarize information, translate information from one form or level to another, or comprehend data trends. To determine whether your students understand something they have observed, you can ask them to describe or explain the observed phenomenon.

Unit Plan Instructional Objective

Example: The students will demonstrate understanding of the physical characteristics of prehistoric animals.

At the Knowledge level, students simply recognize or recall previously learned information without really comprehending or understanding it. At the Comprehension level, students go beyond merely recognizing or recalling information to understand it, which can be demonstrated by summarizing the information.

Daily Instructional Objective

Example: As a written assignment following a field trip to the museum, the students will describe one observed prehistoric reptile, including at least three of its physical characteristics.

Describing a phenomenon is, in itself, a form of summarizing. Hence, this is a Comprehension-level objective. The conditions are basically twofold: “As a written assignment” and “following a field trip to the museum.” The behavior is to “describe” by writing. The measurable standards are “one observed prehistoric reptile,” including “at least three of its physical characteristics.”

Application Level: Students have the ability to take information that has previously been acquired and comprehended and use it in concrete situations.

A field trip is an excellent means for putting classroom acquisitions into actual practice. We use this method in the following example.

Unit Plan Instructional Objective

Example: Students will identify and collect specified leaf samples.

The identification and collection of specified leaf samples are observable behaviors that would occur at the Application level.

Daily Instructional Objective

Example: On a field trip, the students will identify and collect leaves from five different trees, as specified on a list provided by the teacher.

Following the classroom discussion and understanding of leaf types, the students will expand these experiences into the application situations afforded by a field trip. This Application-level objective is precise in its explanation of conditions (“On a field trip”), behaviors (“identify and collect”), and minimal standards of acceptable performance (“leaves from five different trees . . .”).

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

It is likely that you will want your students to go beyond observing and summarizing their observations of phenomena; you will want them to determine cause–effect relationships.

Unit Plan Instructional Objective

Example: The students will demonstrate the ability to determine cause–effect relationships in chemical reactions.

The determination of cause–effect relationships is Analysis-level performance in itself. In the example, the word *demonstrate* prefaces the observable pupil performance in the following daily instructional objective.

Daily Instructional Objective

Example: After observing the mixing of vinegar, mouthwash, instant iced tea, and baking soda in a beaker of water, the students will list the two components causing the reaction.

The three necessary elements are clear and carefully prescribed: conditions (“After observing the mixing of vinegar . . .”), behavior (“list”), and minimal standards (“the two components causing the reaction”).

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

To provide your students with the opportunity for creative and hands-on involvement with previously developed concepts, you may wish to ask them to construct DNA models with LEGO blocks, as in the next example.

Unit Plan Instructional Objective

Example: The students will create models to represent previously developed concepts.

The term *create* defines this as a Synthesis-level objective. Also, if the students are creating models, their behavior is observable.

Daily Instructional Objective

Example: Presented with a set of LEGO blocks, in pairs, students will create a linear DNA model according to their personal creativity, with the requirement that the four bases be correctly paired and color coded.

This Synthesis-level objective is precise in its conditions (“Presented with a set of LEGO blocks, in pairs”) and definite in expected observable behavior (“create”). The standards, as mentioned, are partially determined by the students and partially imposed by the teacher (“a linear DNA model . . .” and “four bases . . .”).

Evaluation Level: Students are able to make value judgments on the basis of predetermined criteria or internal consistency. Since value judgments often involve personal choices, you should assess the students’ rationale for their decisions as opposed to their decisions per se.

Regardless of the content area, at this level, students should be able to make value judgments on the basis of predetermined criteria, internal consistency, or both.

An opinion is not necessarily a hypothesis, because a hypothesis should be testable. For example, a girl may hypothesize that the rose in her mother’s vase is blue because her little brother poured food coloring into the vase a few days ago. As a means of testing her hypothesis, she might place

a second rose in another vase, into which she pours food coloring. Unlike a hypothesis, an opinion is not necessarily testable: Is there life on Jupiter? How did the dinosaurs become extinct? These questions would evoke opinions, which occur at the Evaluation level. To encourage your students' thinking at this level, provide them with opportunities to form opinions.

Unit Plan Instructional Objective

Example: The students will formulate opinions regarding unanswered questions in nature.

This Evaluation-level assignment taps into students' personal, predetermined criteria or their perceptions of the internal consistency of their opinions.

Daily Instructional Objective

Example: After reading three separate theories pertaining to causes of the dinosaurs' extinction, each student will determine which theory appears to be most authentic, listing three reasons for the choice.

This is recognizable as an Evaluation-level objective because it requires the students to judge a phenomenon, either on the basis of their own predetermined criteria or in terms of their perception of the theory's internal consistency. Although students are encouraged to make value judgments, the objective is precise with respect to conditions ("After reading three separate theories . . ."), behaviors ("determine," "list"), and minimal standards ("three reasons for the choice").

Social Studies

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Many units on national government begin by acquainting the students with the names of the three branches, which occurs even before the duties of each branch are defined. This Knowledge-level information is essential to virtually all future examinations of government and serves as our example.

Unit Plan Instructional Objective

Example: The student will display knowledge of the three branches of government.

This is a Knowledge-level assignment, made so by the inclusion of the term *knowledge*. The term *display* communicates that the objective is to be met through observable pupil behavior, which is to be determined by your creativity.

Daily Instructional Objective

Example: On a quiz, students will list the three branches of government, spelling errors excluded.

The objective's conditions are specific ("On a quiz"). The behavior, "list," is simple and clear, and the minimal standards of performance are quantitative and measurable ("*three* branches of government, spelling errors excluded").

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Unit plan objectives at this level and especially the daily instructional objectives should call for students to demonstrate their ability to summarize information, translate information from one form or level to another, or predict continuations in data trends. As a means of determining the extent to which your students understand population trends, present them with population figures from successive years and then ask them to extrapolate to the next year, as we show in our examples.

Unit Plan Instructional Objective

Example: Students will evidence an understanding of population trends in specified areas.

A part of Comprehension is to understand trends in data, which is a requirement of this objective. The objective instructs that this understanding be evidenced by demonstrable pupil behavior.

Daily Instructional Objective

Example: When shown the increasing population figures of their school during the past five years, the students will write the expected approximate figure for the following year.

This facet of the Comprehension level focuses on understanding data trends. The objective does not call for analysis; it simply requires that the students comprehend the progression. The objective is definite in its

specification of conditions (“When shown the increasing population figures . . .”), behavior (“write”), and standards of acceptable performance (“the expected approximate population figure . . .”).

Application Level: Students have the ability to take information that has previously been acquired and comprehended and use it in concrete situations.

The ability to determine the distance between given locations on a map is basic to the study of geography. In the next example, we ask students to use the legend in calculating distances between specific points on a map.

Unit Plan Instructional Objective

Example: The students will read and interpret maps.

The behavioral terms *read* and *interpret* are indicative of Application-level expectations. Hence, the objective is succinct and to the point.

Daily Instructional Objective

Example: When presented with a state map, students will calculate and list the distance between two given points, within a five-mile margin of error.

As indicated by its requirement for students to “calculate and then list,” this is an Application-level objective. Its conditions are clear (“When presented with a state map”), as are its specified behaviors (“calculate,” “list”) and minimal standards of performance (“within a five-mile margin of error”).

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

You may want to assist your students in understanding that social events sometimes have dramatic, far-reaching, and long-lasting results. Perhaps you can simply remind them of such an event and then ask them to analyze how this event has induced change, as we have indicated in the next example.

Unit Plan Instructional Objective

Example: Students will demonstrate the analytical ability to determine that past events have present-day consequences.

Determining cause and consequence is an Analysis-level process, and the objective states that the students must demonstrate this ability.

Daily Instructional Objective

Example: Individually, students will list three ways that the earlier practice of slavery in this country has induced changes in the present-day United States.

This objective asks students to determine a cause-and-effect relationship between slavery and resulting changes within the United States, an Analysis-level assignment. The objective is also clear and distinct in conditions (“Individually”), behavior (“list”), and minimal standards (“three ways”).

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

In the following example, we suggest that after seeing that your students understand the cause-and-effect relationships that characterize economic interdependency, you enhance this understanding by asking them to design an imaginary community characterized by economic interdependency.

Unit Plan Instructional Objective

Example: The students will demonstrate an understanding of economic interdependency through their creation of an imaginary community.

The students’ creation of an imaginary community is a Synthesis-level assignment, and the term *demonstrate* is a prelude to observable pupil behavior in the daily instructional objective.

Daily Instructional Objective

Example: In groups of two or three, students will begin to design an imaginary community consisting of four subgroups, each producing a unique commodity, by listing at least three possible groups.

The term *design* marks this as a Synthesis-level objective. Although it demands student creativity, it is clear in its conditions (“In groups of two or three”), behaviors (“design,” and “list”), and minimal standards (“at least three subgroups”). This would be the first measurable formative assessment for this longer-term project.

Evaluation Level: Students are able to make value judgments on the basis of predetermined criteria or internal consistency. Since value judgments often involve personal choices, you should assess the students' rationale for their decisions as opposed to their decisions *per se*.

Regardless of the content area, at this level, students should be able to make value judgments on the basis of predetermined criteria, internal consistency, or both. Government officials at all levels have differing political and social points of view. Recognizing that these positions may be inconsistent or based on subjective rather than objective criteria, you may want to give your students the opportunity to make rational judgments about political figures or situations, as in the next examples.

Unit Plan Instructional Objective

Example: On the basis of their individual criteria, students will demonstrate the ability to evaluate the performance of public officials.

With the terms *evaluate* and *individual criteria*, this is an Evaluation-level objective. Although the term *evaluate* is open to a variety of interpretations, the objective is precise in its requirement that students demonstrate this ability, thus indicating observable pupil performance in the daily instructional objectives.

Daily Instructional Objective

Example: Presented with a list of three presidents during a unit on presidents of the United States, students will individually select the one whom they perceive as being most effective, listing two facts supporting their choice with respect to the president's performance in each of the two following areas: (1) foreign policy and (2) civil rights.

This is an Evaluation-level objective in that it requires students to make value judgments supported by factual data. The objective is clear in its conditions ("Presented with a list of three . . ."), behaviors ("select," "list"), and minimal standards of performance ("two facts supporting their choices . . .").

English–Language Arts

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Both the unit and the daily instructional objectives should indicate that at this level, students are expected only to demonstrate the ability to recall previously learned information. For our example, we use the defining of assigned words, an activity that spans the spectrum from Grade 1 through Grade 12. This is a Knowledge-level activity at every grade level.

Unit Plan Instructional Objective

Example: Students will show the ability to define assigned words.

Defining assigned words is almost exclusively a Knowledge-level task involving memorization. The term *show* is indicative of the demonstrable pupil performance that should occur in the daily instructional objective.

Daily Instructional Objective

Example: On a twenty-item written vocabulary exercise, students will define at least eighteen of the words correctly.

In practically all instances, defining words is a task performed at the Knowledge level. This objective is exact in its conditions (“On a twenty-item written vocabulary exercise”), behavior (“define”), and minimal standards (“at least eighteen of the words correctly”). It should be noted that by specifying a written exercise, the behavior “define” means to write.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Unit plan objectives at this level and especially the daily instructional objectives should call for students to demonstrate their ability to summarize information, translate information from one form or level to another, or predict continuations in data trends. As in our example, following an introduction to the parts of speech, you may ask your students to demonstrate their understanding of the presentation by circling the adjectives and underlining the adverbs on a written list.

Unit Plan Instructional Objective

Example: The students will reflect an understanding of the parts of speech.

The term *understanding* indicates that students must go beyond merely defining the parts of speech. The term *reflect* makes clear the necessity for observable pupil performance in the daily lesson plan.

Daily Instructional Objective

Example: Given a list of ten words, students will circle the adjectives and underline the adverbs, with no more than two errors.

Expressing an understanding of the differences between adjectives and adverbs is neither Knowledge, Application, nor Analysis: it is a Comprehension-level ability. Let us explain: This ability exceeds Knowledge-level behavior because students cannot memorize all of the adjectives and adverbs in the dictionary. It is not Application, either, because students are not applying acquired and comprehended material in a concrete situation. Because students do not have to distinguish among words within a context (e.g., subject, direct object, indirect object.), it is not an Analysis-level objective. Hence, because students only have to comprehend the difference between adjectives and adverbs, it is a Comprehension-level objective.

Application Level: Students have the ability to take information that has previously been acquired and comprehended and use it in concrete situations.

Most teachers want their students to do more than simply define words from a given list; they want them to be able to use these words. Hence, as in our example, they may ask them to use these words correctly in sentences.

Unit Plan Instructional Objective

Example: Students will use new words correctly in sentences.

The word *use* is synonymous with *apply*, thus indicating the level of the ensuing daily instructional objectives.

Daily Instructional Objective

Example: As a written assignment, students will correctly use at least eight of ten vocabulary words in separate sentences.

Using a word correctly in a sentence is a form of application because one must first understand (comprehend) the meaning of the word. This Application-level objective is specific in its conditions ("As a written assignment"), behavior ("use," which is observable because it is a written assignment), and minimal standards ("at least eight of ten vocabulary words in separate sentences").

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

The ability to separate parts of a whole and note the interrelationships among them is an Analysis-level process that transcends every content area. Recognizing this, you will undoubtedly find a number of ways through which you can assist your students toward this proficiency, such as identifying the basic parts of a letter, as in our example.

Unit Plan Instructional Objective

Example: Students will demonstrate the ability to break down a business letter into its basic parts.

Daily Instructional Objective

Example: Given a business letter, the students must label the heading, greeting, body, and complimentary close.

Labeling the segments of a business letter is an excellent means of breaking down a unit into its basic components while simultaneously noting the interrelationships among its parts. To accomplish this, the students must see how the different parts relate to each other. The objective is definite in its conditions ("Given a business letter"), behavior ("label"), and minimal standards of performance ("heading, greeting, body, and complimentary close").

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

At virtually every grade level, most teachers want to engage their students in some form of creative writing, and more often than not, externally imposed standards enhance rather than inhibit the students' creativity, as per our example:

Unit Plan Instructional Objective

Example: The students will engage in creative writing.

In practically all instances, creative writing is a Synthesis-level process, and if students are engaged in this process in class, their behavior will be observable.

Daily Instructional Objective

Example: As a class assignment, the students will write a short story that contains two main characters, at least two supporting characters, an action event, and a surprise ending, within two pages.

A creative endeavor, involving the writing of an original short story, this objective is clear with respect to its conditions (“As a class assignment”), behavior (“write”), and minimal standards (“a short story that contains two main characters, at least two supporting characters, an action event, and a surprise ending, within two pages”).

Evaluation Level: Students are able to make value judgments on the basis of predetermined criteria or internal consistency. Since value judgments often involve personal choices, you should assess the students’ rationale for their decisions as opposed to their decisions per se.

Regardless of the content area, at this level, the student should be able to make value judgments on the basis of predetermined criteria, internal consistency, or both. At some point, you may want your students both to compare different literary selections and to evaluate these selections on the basis of their comparisons.

Unit Plan Instructional Objective

Example: Students will display the ability to evaluate the merits of literary selections.

Many evaluations are made from a baseline of predetermined criteria. In this instance, you would instruct your students to make literary evaluations on the basis of their personally predetermined criteria. The objective states that the students “display” their evaluations, indicative of observable behavior that you will describe in the daily objectives.

Daily Instructional Objective

Example: After reading *The Adventures of Tom Sawyer* (Twain, 1876) and *Where the Red Fern Grows* (Rawls, 1961), students will individually decide which better reflects traditional, rural, American values and then write at least three reasons for their choices.

This Evaluation-level objective involves personal selectivity based either on students’ perception of the novel’s internal consistency regarding “traditional, rural, American values” or on their own determination of

these values. Regardless, the objective is precise in its conditions (“After reading *The Adventures of Tom Sawyer* and *Where the Red Fern Grows*”), behavior (“write”), and minimal standards (“at least three reasons”).

SUMMARY

We have demonstrated that the unit plan, although somewhat general, conveys what should be accomplished in the subsequent daily instructional objectives, which should definitely be highly specific in its conditions, behaviors, and minimal standards of performance. They should eliminate any need for translation: They should be explicitly clear to students, teachers, parents, and curriculum directors. The conditions should describe when, where, or under what circumstances a particular behavior should occur, the behavior should be observable, and the minimal standards should be measurable.

We have demonstrated the importance of the sequential simple-to-complex structure of Bloom’s pyramidal Taxonomy and how an understanding and acceptance of the dependency of each level on the previous levels make for a smooth ascent through the complexities of the higher-order thinking skills of any content area.

PROFESSIONAL DEVELOPMENT ACTIVITIES

In groups of three to five members, write unit plan objectives for the Knowledge level for any subject matter area. Be sure to include a precursor (“demonstrate,” “evidence,” “reflect,” etc.) that indicates the observable performance that will be specified in the daily instructional objective. Make certain that your unit plan objective does not have the high level of specificity that will characterize your daily instructional objective.

From your unit plan objective, construct your daily instructional objective. Here, clarity of intent is very important. This objective must be vividly clear, devoid of any need for interpretation. Include the three components (behavior, conditions, and minimal standards), but be succinct, remembering that wordiness serves only to confuse. The conditions will describe when or where a particular behavior is to take place. For this behavior, use an action verb, one that can be observed. Last, your standards of acceptable performance should be easily measurable. For example, do not specify that the students will recite 80% of the alphabet; this is meaningless. Instead, specify that they will recite the alphabet in sequence with no more than two errors.

When you have completed the assignment, put it on the board or overhead for discussion. Then do the same thing for Comprehension, Application, Analysis, Synthesis, and Evaluation.

WWW RESOURCES

<http://www.gsu.edu/~mstmbs/CrsTools/Magerobj.html>

This Web site of George Mason University gives a synopsis of Mager's approach to the writing of instructional objectives.

<http://edtech.tennessee.edu/~bobannon/>

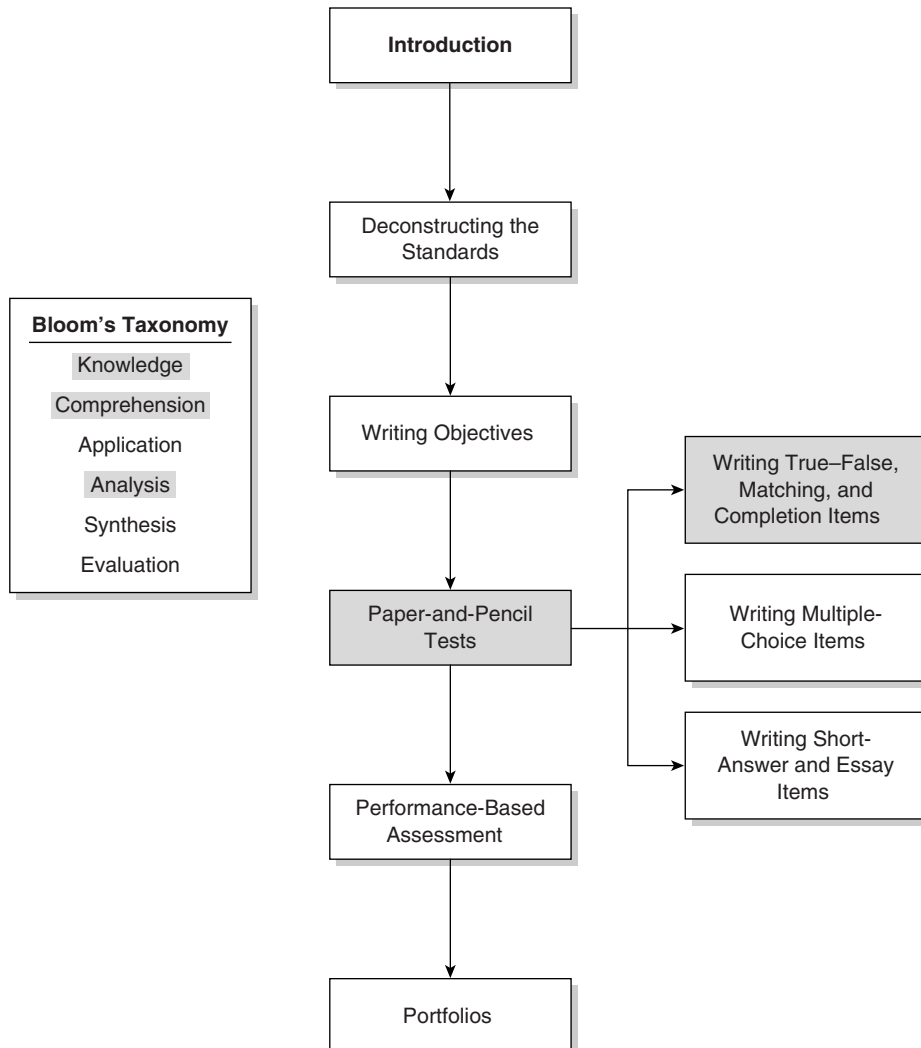
This Web site of The University of Tennessee is an online module designed to assist preservice teachers in developing unit plans and lesson plans that guide instruction in K–12 classrooms.

<http://edweb.sdsu.edu/courses/EDTEC540/objectives/ObjectivesHome.html>

This Web site of San Diego State University proffers techniques for writing valid instructional objectives that are commensurate with given problems.

3

Writing True–False and Completion Items and Matching Exercises



Your daily instructional objectives, which we discuss in Chapters 1 and 2, can serve as excellent baselines for your formative assessments. They can convey the daily progress of your students, and they can also alert you to any need to alter your teaching methods or pacing, thus contributing to your summative assessments.

Suzanne Fodor, a teacher from Slippery Rock, Pennsylvania, describes how daily instructional objectives allow for continual formative assessments, which in turn provide for adjustments in teaching methodologies that result in the enhancement of her students' academic performances:

As an experienced teacher, I have learned the value of flexible planning and frequent, multiple assessments. Specifically, without such planning and assessments, I really would have no idea of whether the method or pace of my instruction is conducive to optimal student performance, or whether my selected means of assessment accurately convey my pupils' progress.

When I was a new teacher, I had the tendency to cover too much material much too quickly. I once taught an entire unit on meteorology under the assumption that my students would study each day and then be ready for my summative assessment, which would come in the form of a unit test consisting entirely of multiple-choice items. From the disastrous results of this test, I immediately understood that if the students weren't learning, the teacher probably hadn't done a very good job of teaching.

In reteaching this unit, my daily instructional objectives included frequent and multiple types of formative assessment, which allowed me to align my teaching methods with the learning rates and styles of my students. Then, instead of consisting exclusively of multiple-choice items, my unit test also included models that my students were both to draw and complete to demonstrate their understanding of the material. Undoubtedly, the results of this second unit test were more favorable to my students, as well as to me.

As a teacher, I am like a health-care specialist engaged in preventative medicine. This medical specialist prescribes programs designed for the wellness of the patients, which is determined by their frequent checkups. These checkups, in turn, provide for continual adjustments in the patients' programs. Analogous to the health-care specialist, I design instructional objectives for the academic health of my students; and a variety of frequent, formal assessments allows me to make instructional adjustments directed toward the enhancement of my students' performance. (S. Fodor, personal communication, July 25, 2008)

Paper-and-pencil tests, which we discuss in depth in this chapter as well as Chapters 4 and 5, can serve as bases for both formative and summative assessments, as can the various types of performance-based activities described in Chapter 6 and the portfolio process described in Chapter 7.

THREE KINDS OF TEST ITEMS

True–False Items

The **true–false** test is an effective and economical instrument for measuring the acquisition of specific facts. Like the multiple-choice test, it provides for wide sampling in a relatively short period of time. Unlike the multiple-choice test, it is restricted in its measurement of higher-order thought processes. True–false tests can measure cognitive functions well at the Knowledge level and in some instances also at the Comprehension level within any content area, as we demonstrate.

Some test constructors have attempted to measure higher-level thought processes by designing a more sophisticated alternative to the standard true–false item. In this variation, students are asked to fill in a blank that will make a false statement true (Linn & Gronlund, 2000). Although items that are partially true and partially false have certain merit, they can be confusing and potentially interfere with maximum test performance. For this reason, we advocate essay or short-answer items for measuring higher-order thought processes. We recommend that true–false items be used primarily at the Knowledge level and sparingly at the Comprehension level.

Guidelines for Constructing True–False Questions

True–false items, like any other items, should be clear, precise, and understandable to students. They should be short, and concise, and contain one single thought free of ambiguities and contradictions. Box 3.1 gives you both poor and good examples.

Box 3.1

Poor Example: George Washington, John Adams, Thomas Jefferson, Benjamin Franklin, and Abraham Lincoln each served as president of the United States.

With its inclusion of five names, this item is excessively long and confusing. Moreover, four of the names make it a true statement, whereas the name of Benjamin Franklin makes it a false statement.

Good Example: Thomas Jefferson served as president of the United States.

Good Example: Benjamin Franklin served as president of the United States.

An exception to the single-thought principle is the occasional use of a qualifying clause within an item. However, it should be remembered that qualifying clauses often indicate to the examinees that the item is true, regardless of whether they actually know the answer. Qualifiers such as “possibly,” “often,” and “occasionally” are usually indicators of true responses. Students learn to recognize that items that are proportionately longer also have a tendency to be true. Conversely, absolutes such as “every,” “never,” or “all” indicate to the students, very early in their academic careers, that the item is false. Also, many students easily recognize patterns such as TTFF; but these unintentional clues can be avoided through the random placement of correct responses, accomplished through the toss of a coin.

Completion or Fill-In-the-Blank Items

The **completion** item can be a highly objective medium for measuring the acquisition of factual information. However, to use it for measurement beyond the Knowledge level is asking it to do something it’s not built to do. For example, you would not use a completion item to measure an Analysis-level achievement, such as knowing what characteristics are shared by birds and butterflies.

Remember, the completion item is considered to be an objective item; the foregoing example is not an objective item. Like this one, completion items are often misused and abused, to the confusion of the student. This confusion can be avoided if certain principles of construction are followed.

Guidelines for Constructing Completion Items

The answer blank should always be placed at the end of the item, not at the beginning and not in the middle. The reason is that the stem should clearly present a problem to be solved in the answer blank. If the blank is in the middle or at the beginning of the stem, or even worse, if there is more than one blank, the examinees are likely to waste considerable time and patience in attempting to determine exactly what is expected. With the stem forming a problem to be answered in the blank, students know what is expected of them. If they do not fill in the correct response, it is because they do not know the answer, not because they do not understand the problem. Box 3.2 gives you examples.

Box 3.2

Bad Example: On July 1, 1863, the _____ began during the Civil War.

Good Example: The name of the Civil War battle that began on July 1, 1863, is the _____.

Another problem that many neophyte test constructors have with the completion item lies in devising items that provide for one and only one correct answer.

Box 3.3

Bad Example: Columbus first came to the New World in (a boat, a hurry, etc.).

Good Example: Columbus first came to the New World in the year (1492).

Although we do not want to confuse our students with the structure or wording of the item, we also do not want to give unintentional clues by the number of blank lines in the answer blank. Hence, there should be one uniform line for all of the completion items on the test, regardless of whether the item can be answered with a single word or date, or with a phrase or a list. Box 3.4 gives examples.

Box 3.4

Bad Example: The name of the author who wrote *Charlotte's Web* is _____.
_____.

Good Example:

The name of the author who wrote *Charlotte's Web* is _____.

Bad Example: Patrick Henry is most noted for his phrase "_____.
_____."

Good Example:

Patrick Henry is most noted for his phrase "_____."

Bad Example: If the clothes you are wearing catch fire, you should _____,
_____, _____.

Good Example:

If the clothes you are wearing catch fire, you should _____."

The indefinite articles (*a* and *an*) should be excluded from the stem, as well as any numbers (see Box 3.5).

Box 3.5

Bad Example: The part of speech that names a person, place, or thing is a _____.

Good Example: The part of speech that names a person, place, or thing is _____.

(Continued)

(Continued)

Bad Example: The names of the three primary colors are _____.

Good Example: The names of the primary colors are _____.

In the two good examples, the indefinite article *a* and the number *three* are excluded. The absence of these two terms enables students to complete the item without the assistance of a hint or a clue.

The completion or fill-in-the-blank item lends itself to Knowledge-level testing in virtually all of the content areas in the general K–12 curriculum.

Matching Exercises

Because of its compact efficiency, the **matching exercise** can cover a broad latitude of associative information. It can measure a multiplicity of relationships between various phenomena. Although most of these associations are restricted to facts, they can extend into understanding, as defined at the Comprehension level, and even into categorization of data and determination of cause–effect relationships, at the Analysis level.

Guidelines for Constructing Matching Exercises

In a matching exercise, items that typically fall on the left-hand side of the page are called *premises*, such as the names of states. The items on the right-hand side are called *responses*, such as the names of the state capitals. The premises and responses should be homogenous to ensure the associative nature of the exercise, as in the following example:

Match the states with their capital cities.

- | | |
|----------------------|----------------|
| ___1. Louisiana | a. Austin |
| ___2. Texas | b. Raleigh |
| ___3. Pennsylvania | c. Baton Rouge |
| ___4. Nevada | d. Harrisburg |
| ___5. North Carolina | e. St. Paul |
| | f. Carson City |

As with any other test exercise, the format and wording of the matching exercise should be easy to understand. However, neither the

wording nor the format should give clues to the correct response. As prevention against unintentional clues, the number of possible responses should be greater than the number of premises—as in the previous example. This narrows the probability that student will arrive at the correct answer through the process of elimination, as opposed to informed selection. However, an exception to this may occur in instances where responses may be used more than once; in such cases, the directions should specify that responses may be used more than once.

Linn and Miller (2005) contend that “There certainly should be no more than ten items in either column” (p. 183) to make instructional adjustments directed toward the enhancement of students’ performance. However, we feel that the number of premises should not be fewer than five or more than eight for elementary students, and no less than five and no more than ten for secondary students. Should you determine that more associations are necessary, fine; simply include more matching exercises. Make certain that each matching exercise is contained on one page; turning back and forth can cause students to lose their train of thought.

For ease of understanding, both the premises (on the left) and the responses (on the right) should be brief, with the response items shorter—for instance, an event (left) and its date (right). The principle is analogous to that of the multiple-choice item, whose stem presents a problem (premise) that is solved by the correct option (response).

COGNITIVE LEVELS SUITABLE FOR THE THREE KINDS OF TEST ITEMS

For each cognitive level in each content area, we start with a brief statement of the defining characteristics of that level, so you will see this many times.

True–False Items

Mathematics

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

True–false tests are an economical means for sampling your students’ knowledge of memorized material—their multiplication facts, for instance.

F Nine (9) is a multiple of two (2).

This is a Knowledge-level item in that, with the exception of chance, the correct response is dependent on students' knowledge and recall. Structurally, the item is short and to the point and contains a single thought.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

For instance, to determine if your students understand the commutative properties of numbers, the true-false test is an adequate vehicle.

T $3 + 4 = 5 + 2$

In this Comprehension-level item, students must understand two forms of seven. Once again, the item is condensed and clearly stated.

Science

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

After introducing classes within the animal kingdom, it is appropriate to use a true-false test to sample your students' knowledge of some of the unique characteristics of the classes. For example,

T Mammals are warm blooded.

This is a Knowledge-level item in that the intended correct response depends on student memory. The structure of the item is tight and terse and contains a single thought.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

You can use the true-false test effectively in determining your students' comprehension of the role of marine biologists, for example.

F The role of a marine biologist is to search for food.

This is not a memory-level item because it requires a general understanding of a marine biologist's job. Structurally, the item is brief and easy to understand and contains a single thought.

Social Studies

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Knowledge of the three branches of the federal government is essential to understanding the workings of the U.S. government, and the true-false test is adequate for sampling your students' factual knowledge of these branches. For example,

F The Domestic Branch is a branch of the federal government.

Clear, succinct, and devoid of ambiguities, this statement simply tests students' recognition of previously presented material.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

A demonstrated understanding of the general meaning of a written passage is a behavior that is expected at the Comprehension level. The true-false item can be a means of determining students' comprehension of the meaning of some of the Constitutional Amendments, for example.

F The Second Amendment advocates gun control.

This item requires an understanding of the basic meaning of the Second Amendment. Also, this requirement is succinctly and clearly stated, with a single thought.

English-Language Arts

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

For instance, you may want your students both to be able to spell certain words and to recognize the correct spelling of them, which is another Knowledge-level activity. True-false items are well-suited for testing this ability.

F The correct spelling of our state is Pennsavana.

The incorrect spelling of the word in the item reflects the way many citizens of the state pronounce it. Items such as this are brief, clear, and provide for wide sampling in a short period of time.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

For instance, understanding the general geographical setting of a literary piece is a Comprehension-level task. A true–false item can determine your students’ comprehension of the general setting of an assigned reading. For example,

T *Charlotte’s Web* takes place in a rural setting.

As you can see, this item is terse and straightforward and contains a single, clearly stated thought.

Completion or Fill-in-the-Blank Items

Mathematics

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

The completion exercise is a good way to sample students’ knowledge of their multiplication facts; for instance,

$$9 \times 7 = \underline{\quad 63 \quad}$$

This is a Knowledge-level item in that it measures a problem involving recall, which is solved in the answer blank.

Science

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

For example, a completion test samples students’ knowledge of scientists and their discoveries very well.

The first and last names of the scientist who discovered radioactivity of thorium are Marie Curie.

Knowledge-level in that it requires the memorized association of a discovery and a scientist, this item provides for one answer in the single answer blank at the end of the item, and no clues are provided in the stem itself.

Social Studies

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

For example, a completion test can sample your students' knowledge of the material covered on an Early American History unit.

The names of the ships that sailed on Columbus's first voyage to the New World were the Niña, Pinta, and Santa Maria.

A memory-level item, it requires students to recall the names of Columbus's three ships. Structurally, it requires a list, but no clues are given by the number of lines in the answer blank or by the length of the line. Moreover, the term *three* is not used in the stem, to prevent an unintentional clue. Instead, the definite article *the* is used to indicate that all of the ships should be listed, without hinting at the answer.

English-Language Arts

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

To sample your students' knowledge of books and their respective authors, the completion test is an excellent device. For example,

The name of the author of *Charlotte's Web* is E. B. White

This is a Knowledge-level item, involving rote memorization. The well-designed stem presents a problem that provides for one correct answer, to be written on a single, uniform-length answer blank.

Matching Exercises

As mentioned, a primary strength of the matching exercise is its effectiveness in measuring knowledge concerning associations of facts. There are instances, however, when it can also be a useful tool for measuring (a) understanding of general ideas (Comprehension) and (b) the ability to categorize and determine cause-and-effect relationships, understand the relationships among the parts of a unified whole, and understand metaphor (Analysis).

Mathematics

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

The matching exercise can be an instrument for determining your students' knowledge of multiplication facts, for instance:

The answers to the problems in Column A are found in Column B. Write the letter of the correct answers in the line to the left of the items in Column A. No answer may be used more than once.

A		B
<u>f</u> 1.	2×2	a. 14
<u>d</u> 2.	2×8	b. 12
<u>b</u> 3.	2×6	c. 6
<u>g</u> 4.	2×5	d. 16
<u>a</u> 5.	2×7	e. 18
<u>e</u> 6.	2×9	f. 4
		g. 10

Knowledge-level because it measures students' knowledge of multiplication facts, this exercise contains more possible answers than problems, and the directions instruct that no answer may be used more than once.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

As an example, you can use the matching exercise to test your students' understanding that fractions have decimal equivalents, and vice versa:

In the blank to the left of each fraction in Column A, write the letter of its decimal equivalent, found in Column B. No decimal may be used more than once.

A		B
<u>e</u> 1.	$1/10$	a. 0.25
<u>c</u> 2.	$1/5$	b. 0.50
<u>f</u> 3.	$1/4$	c. 0.20
<u>b</u> 4.	$1/2$	d. 0.30
<u>f</u> 5.	$3/4$	e. 0.10
		f. 0.75

Comprehension level because it requires students to understand the decimal forms of fractions, this matching exercise has more possible responses than premises, and the directions specify that no decimal may be used more than once.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

For example, you could use the matching exercise to sample your students' understanding of the interrelationships among the components of particular monetary units.

In the blank beside each monetary unit in Column A, write the letter of the exact sum of its parts from Column B. No sum from Column B may be used more than once.

A	B
<u>c</u> 1. One-dollar bill	a. 9 one-dollar bills, 2 quarters, 2 dimes, 5 nickels, 5 pennies
<u>f</u> 2. Five-dollar bill	b. 9 five-dollar bills, 4 one-dollar bills, 2 quarters, 2 dimes, 5 nickels, 5 pennies
<u>a</u> 3. Ten-dollar bill	c. 2 quarters, 2 dimes, 5 nickels, 5 pennies
<u>e</u> 4. Twenty-dollar bill	d. 2 ten-dollar bills, 2 five-dollar bills, 2 quarters, 2 dimes, 5 nickels, 5 pennies
<u>b</u> 5. Fifty-dollar bill	e. 1 ten-dollar bill, 1 five-dollar bill, 4 one-dollar bills, 2 quarters, 2 dimes, 5 nickels, 5 pennies
	f. 4 one-dollar bills; 2 quarters; 2 dimes; 5 nickels; 5 pennies

This Analysis-level exercise requires students to understand the relationships among the components of specific monetary units. We have designed it so there are more combinations than units, and the directions state that no combination may be used more than once.

Science

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

For instance, you can effectively use a matching exercise to determine your students' knowledge of the respective families of familiar animals.

On the line to the left of each animal in Column A, write the letter of its corresponding family from Column B. ***Families may be used more than once.***

A	B
<u> a </u> 1. Coyote	a. Canidae
<u> a </u> 2. Dingo	b. Felidae
<u> c </u> 3. Iguana	c. Iguanidae
<u> d </u> 4. Kangaroo	d. Macropodidae
<u> b </u> 5. Lion	
<u> b </u> 6. Panther	

This is a Knowledge-level exercise, with its mandate for student recall, and the directions specify in ***bold italics*** that the responses may be used more than once. Here it is important to understand that though the required thought process may seem complex, if students are given the information per se, it is a Knowledge-level process. The students are recalling memorized facts; they are not classifying the animals.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

For instance, you can use a matching exercise to sample your students' comprehension of scientific synonyms.

In the blank at the left of each term in Column A, write the letter of its synonym from Column B. No synonym from Column B may be used more than once.

A	B
<u> b </u> 1. Speed	a. Satellite
<u> e </u> 2. Force	b. Velocity
<u> f </u> 3. Moon	c. Nonconductor
<u> f </u> 4. Sun	d. Neutron
<u> c </u> 5. Insulator	e. Strength
<u> g </u> 6. Wire	f. Star
	g. Conductor

In this Comprehension exercise, each scientific term in Column A has a corresponding synonym in Column B, but there are more possible responses than premises, and the directions specify that no synonym may be used more than once.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

Analysis-level thinking can involve determining the style of a piece of literature or music or even the right dinosaur to fit a description. With this in mind, you could use the matching exercise to sample your students' ability to analyze clues that can reveal the identities of given dinosaurs.

In the blank beside each of the characteristics in Column A, write the letter from Column B of the dinosaur that fits that description. No dinosaur may be used more than once.

A	B
<u>a</u> 1. We wear armor and have a club.	a. Thecondonts
<u>f</u> 2. Even though our tails are short, we are bigger than Brontosauruses.	b. Stegosauruses
<u>c</u> 3. Although we are four feet long, some say we look like ducks.	c. Ornithopods
<u>a</u> 4. If it weren't for us, there would be no dinosaurs.	d. Ceratopians
<u>d</u> 5. We wear helmets and have horns.	e. Theropods
<u>b</u> 6. We wear armor and can hit our attackers with spikes.	f. Brachiosauruses
	g. Ankylosauruses

This Analysis-level exercise requires students to analyze clues to arrive at the right answers. It has more dinosaurs than descriptions, and the directions state that no dinosaur may be used more than once.

Social Studies

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

A matching item is an excellent way to determine such things as the extent to which your students remember which government offices are associated with municipal, state, or federal government:

On the line beside each of the government offices in Column A, write the letter of the government division to which it belongs, from Column B. *Some divisions may be used more than once.*

A	B
<u>c</u> 1. Director of the FBI	a. Municipal
<u>a</u> 2. Mayor	b. State
<u>a</u> 3. Commissioner	c. Federal
<u>c</u> 4. Secretary of Defense	
<u>b</u> 5. Governor	
<u>a</u> 6. Councilman	
<u>b</u> 7. Lieutenant Governor	

This exercise involves rote memorization, and the directions specify in ***bold italics*** that some of the responses may be used more than once.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Although federal, state, and municipal forms of government are often studied separately, you may wish to determine the extent to which your students comprehend that most offices within any of these three levels of government have counterparts in the other levels, which means they must translate information from one form or level to another. The matching exercise is an efficient means for sampling such comprehension.

In the blank beside each of the municipal offices listed in Column A, write the letter of its federal counterpart, listed in Column B. No federal office may be used more than once.

A	B
<u>c</u> 1. Mayor	a. Speaker of the House
<u>e</u> 2. Mayor pro tem	b. Secretary of State
<u>a</u> 3. City Council President	c. President
<u>f</u> 4. City Council Member	d. Attorney General
<u>d</u> 5. District Attorney	e. Vice President
	f. Congressman

This is a Comprehension-level exercise because it requires students to understand that each municipal office in Column A has a federal counterpart in Column B. So that no clues are given, there are more federal than municipal offices, and the directions instruct that no federal office may be used more than once.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

For instance, you could well use the matching exercise to sample your students' ability to determine the identities of Revolutionary figures through given clues, an Analysis-level process.

On the line beside each of the characteristics in Column A, write the letter from Column B of the name of the Revolutionary person best associated with it. No person may be used more than once.

A	B
<u>a</u> 1. A statesman who wrote aphorisms	a. Benjamin Franklin
<u>f</u> 2. A craftsman of wood and precious metal	b. Patrick Henry
<u>e</u> 3. A man of reason	c. Thomas Jefferson
<u>d</u> 4. An unorthodox strategist	d. Francis Marion
<u>c</u> 5. A designer of classical architecture	e. Thomas Paine
<u>b</u> 6. A man who openly expressed his love of freedom	f. Paul Revere
	g. George Washington

In the design of this Analysis-level exercise, there are more persons than clues, and the directions emphasize that no person may be used more than once.

English–Language Arts

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Remembering definitions is a Knowledge-level activity; you could use a matching exercise to measure your students' knowledge of vocabulary definitions, such as this one:

On the line to the left of each definition in Column A, write the letter from Column B of the vocabulary word it defines. No word may be used more than once.

A	B
<u> d </u> 1. A grassy area	a. City
<u> c </u> 2. An area of clustered trees	b. Barracks
<u> f </u> 3. A residential area near a city	c. Forest
<u> e </u> 4. An area where games are played	d. Meadow
<u> g </u> 5. An area that confines animals	e. Stadium
<u> b </u> 6. An area where soldiers live	f. Suburb
	g. Zoo

Involving remembering definitions, this is a Knowledge-level exercise. The directions specify that no response may be used more than once, and there are more responses than premises, thus increasing the probability that correct responses will be obtained through direct selection as opposed to the process of elimination.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

For example, determining the part of speech of a given word is a Comprehension-level activity because it does not involve memory (Knowledge) and it does not require that the word be used in a concrete situation (Application). A matching exercise can sample your students' understanding of the parts of speech:

On the line beside each of the words in Column A, write the letter from Column B of its part of speech. Parts of speech may be used more than once.

A	B
<u>a</u> 1. Cat	a. Noun
<u>a</u> 2. House	b. Verb
<u>c</u> 3. Quick	c. Adjective
<u>b</u> 4. Recite	d. Adverb
<u>b</u> 5. Sing	
<u>b</u> 6. Slowly	
<u>b</u> 7. Strong	

This is a Comprehension-level exercise since students must evidence an understanding of the parts of speech. However, they do not have to determine how the words relate to each other, which would lift the exercise to the Analysis level, as in the next example.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

As an example, to distinguish among the subject, direct object, indirect object, and object of a preposition within a sentence is an Analysis-level process because each of these components is a noun. Making these distinctions is dependent on students' understanding of how the different components relate to each other within the sentence. A matching exercise is a means of sampling your students' ability to determine such relationships within a sentence:

This sentence is the basis for the following matching exercise:

"The tall center quickly threw the quick guard one of the tosses."

In the blank next to each of the words from the sentence in Column A, write the letter from Column B of its part in the sentence. No part may be used more than once.

A	B
<u>e</u> 1. center	a. Adverb
<u>a</u> 2. quickly	b. Object of the preposition
<u>f</u> 3. threw	c. Adjective
<u>g</u> 4. guard	d. Direct object
<u>d</u> 5. one	e. Subject
<u>b</u> 6. tosses	f. Verb
	g. Indirect object

This is an Analysis-level exercise because students must break down the sentence into its basic parts and understand the interrelationships among them. There are more possible responses than premises, and the directions specify that no part of speech may be used more than once.

SUMMARY

This chapter has covered three types of assessment items: true–false, completion or fill-in-the-blank, and matching. The true–false and completion items are best used for measurement in the lower cognitive levels as defined by Bloom’s Taxonomy. The matching exercise is conducive to Analysis-level measurement in addition to its suitability for measurement in the two lower levels.

True–False Items

True–false items provide for wide sampling of Knowledge- and Comprehension-level performance in a comparatively short time period. We feel true–false items that go beyond these first two levels are confusing to students, thus preventing maximum performance. These items should be short, for ease of reading and understanding, and contain a single, noncontradictable statement. True–false items are an effective measurement tool within the major content areas.

Completion or Fill-In-the-Blank Items

Not to be confused with the short-answer item, the completion or fill-in-the-blank item is excellent for assessing the acquisition of factual

information. Regrettably, however, this item is often poorly structured, to the confusion of student, or its wording provides unintentional clues to the correct response. However, with uniform structure and direct wording devoid of clues or insinuations, you can construct items that will neither confuse nor assist your students. This item is an effective measurement tool in all of the major content areas.

Matching Exercises

The matching exercise allows for a wide sampling of associative information within a relatively short period of time. This assessment tool is not confined to the Knowledge level: It can also effectively test students at the Comprehension and Analysis levels in all the major content areas. Yet valid assessment is dependent on clarity and specificity. Thus the wording and format should be understandable to students, but neither the wording nor the format should serve as clues to correct responses.

PROFESSIONAL DEVELOPMENT ACTIVITIES

1. In three- or four-member groups, select a content area and then write a true–false item that samples student behavior in each of the following levels: Knowledge and Comprehension. Be sure to review the guidelines for constructing true–false items, as well as the definitions of the Knowledge and Comprehension levels. Along with members from the other groups, put your Knowledge-level item on the board for discussion. Then do the same for your Comprehension-level item.

2. In your groups, write a Knowledge-level completion item. Review the guidelines carefully, remembering that the stem should present a problem to be answered in a *single* answer blank that will complete the sentence. Also, provide for one correct answer, but give no clues in the stem. Upon completion, put your item on the board for discussion, along with the items of the other groups.

3. In your groups, write one matching exercise for each of the following levels:

1. Knowledge
2. Comprehension
3. Analysis

Review your definitions for each of these cognitive levels and review the guidelines for constructing the matching exercise. You can use the chapter examples that pertain to your subject area as templates.

WWW RESOURCES

<http://captain.park.edu/facultydevelopment/true-false.htm>

This Web site of Park College furnishes information regarding the construction, strengths, and weaknesses of the true-false item.

http://web.utk.edu/~mccay/apdm/t_false/t-f_b.htm

This Web site of the Alabama Department of Education gives suggestions on the writing of matching, true-false, and completion questions.

<http://uwf.edu/atc/assessment/True-False.cfm>

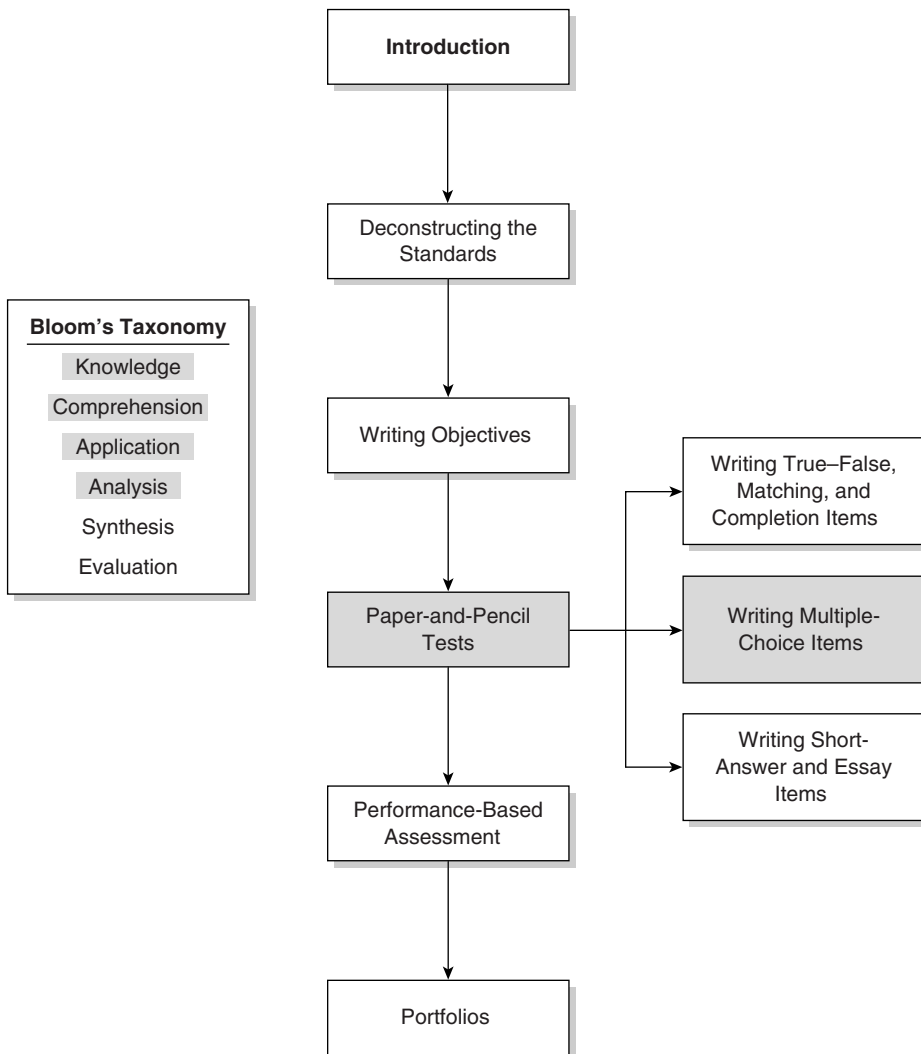
This Web site of the University of West Florida provides suggestions for writing effective true-false questions.

<http://artswork.asu.edu/arts/teachers/assessment/forced2.htm>

This Web site of Arizona State University gives suggestions on writing true-false questions.

4

Writing Multiple-Choice Items



With the nationwide dictate for standardized testing, your mandated involvement with multiple-choice items has probably already exceeded your projective powers and will likely persist indefinitely. Understandably, you may be as overwhelmed by these items as are your students. However, as this chapter will demonstrate, there is reason for the widespread use of multiple-choice items on standardized as well as teacher-made tests.

As evidenced by the disproportionate number of psychometrically approved **multiple-choice** items on standardized achievement and aptitude tests, this may be the single most powerful, versatile, and economical test that is currently available to teachers, administrators, accountability officers, and admission officials. This does not indicate that this is the best test, however, because there is no such instrument. The best test is the one that best suits the examiner's purpose. Still, the multiple-choice test is readily adaptable to the measurement of academic achievement at most cognitive levels within each of the major content areas. It is conducive to the use of illustrations and interpretations and can measure the understanding and application of facts and concepts, as well as the ability to separate unified wholes into connected relationships. Moreover, it provides for a wide sampling of material during a relatively brief period of time at each of the hierarchical levels, with the exception of Synthesis and Evaluation, which we perceive as the only two levels within the Taxonomy that call for *divergent* as opposed to *convergent* thinking. To clarify, convergent thinking leads to conventionally accepted test answers, such as $2 + 2 = 4$. Divergent thinking, on the other hand, can travel in many different directions, such as writing a unique story or defending a political position. We discuss the best options for divergent thinking in subsequent chapters.

A primary reason for the multiple-choice item's effectiveness in the measurement of higher-order thinking skills is its provision for homogeneous options: the more homogeneous the options, the more challenging the item. This homogeneity gives the multiple-choice test its discriminative powers.

A criticism of this item is the difficulty of devising a single best option. As previously mentioned, homogeneity within the options of an item is essential, but there has to be one best option. It is the responsibility of the test constructor to provide for one best response while simultaneously maintaining similarity among the distracters. Another problem is the difficulty in constructing plausible distracters. If two of the distracters on a four-option item are obviously incorrect, it becomes a true-false rather than a multiple-choice item. Yet such weakness can be avoided by a competent and conscientious teacher.

GUIDELINES FOR CONSTRUCTION

For the test to be effective, it is important that students understand it. Otherwise, the teacher has no idea of whether erring students simply do not know the answer or are confused by item wording or test format.

The stem of the multiple-choice item should vividly and succinctly present a problem that is answered by the correct option. The item can be presented as an incomplete sentence or simply as a question:

Incomplete Sentence

_____ The year Columbus first came to the New World was

- A. 1865.
- B. 1861.
- C. 1776.
- D. 1492.

Question

_____ In what year did Columbus first come to the New World?

- A. 1865
- B. 1861
- C. 1776
- D. 1492

The incomplete sentence is often preferred, but use it only if it can be stated clearly and understandably. Rather than risk an awkward statement, which can involve time-consuming and questionable interpretation, state the item in question form. In either case, the item should usually be stated positively. When a negatively stated stem is preferred, the negative word (e.g., *not*) should be underlined or in *italics* so that the intent of the stem is clear.

_____ Which of the following is *not* a southern state?

- A. Alabama
- B. New York
- C. Mississippi
- D. Louisiana

Format the options vertically rather than horizontally for ease of isolation and comparison. As an additional deterrent to pupil confusion, make the options proportionately shorter than the stem, which also eases the comparison between possible solutions and the problem.

Teachers often wonder about the optimal number of options. Though there is a range of three to six options, having four or five seems to be the norm. Yet whether you prefer four or five options, you should be completely consistent throughout the test, thus providing a uniformity of structure that promotes concentration by eliminating the uneasiness that often accompanies uncertainty.

As we have stressed, students should not miss an item because of awkward wording or confusing format. They also should not make the correct response because of unintentional clues given by the test constructor, such as the patterning or consistent placement of correct responses. It does not take observant students long to discover an ACBD pattern or to see that the third option is most often the correct response. Such patterns and consistencies are understandable when you recognize the habitual nature of people (notice how students usually sit in the same classroom seats, even when seats are not assigned). The roll of a single die will ensure that your correct answers are randomly placed.

To make certain that there is one best answer, less-competent test constructors often make the correct option considerably longer or noticeably shorter than the distracters. In either case, the students may well select the correct option not because they know the answer but because they recognize unintentional clues.

Another attempt to provide for a best response is the inclusion of the “All of the above” option. Although this is acceptable, it should not always serve as the correct response; sometimes it should be a distracter.

“None of the above” is another favorite option of neophyte test makers. A primary reason for its favored status is that neophyte teachers have exhausted their supply of plausible distracters. Since many students understand this, the item now has three, rather than four options.

CONTENT AREAS AND COGNITIVE LEVELS

As in Chapter 3, for each cognitive level in each content area, we start with a brief statement of the defining characteristics of that level.

Mathematics

Although not often used in this area, you can include multiple-choice items in your tests of mathematics achievement with assurance; they can

effectively measure student performance at the Knowledge through the Analysis levels.

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

For example, say you decide to see how well your students have learned their assigned multiplication facts. Here is a sample test item:

D The product of 2×8 is

- A. 10.
- B. 12.
- C. 14.
- D. 16.

This is a Knowledge-level item because involves memorization. It is structurally sound in that the stem is long, the options are short and the same length, the distracters are plausible, and it provides for one correct answer.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Knowing that the ability to understand trends in mathematical data is an important aspect of mathematics, you probably use colored blocks, shapes, or other manipulatives to acquaint your students with patterns. Then you move from concrete objects to the abstraction of written numbers. The multiple-choice item is a suitable device for determining how well your students understand number patterns. For example,

C The next number in the numerical pattern 2, 5, 8, 11 is

- A. 12.
- B. 13.
- C. 14.
- D. 15.

This Comprehension-level item requires that students see the trend in numerical data. The numbers in the stem have sufficient length to show a pattern without providing an obvious clue, the distracters are brief and plausible, and there is one correct answer.

Application Level: Students are able to take information that has previously been acquired and comprehended and use it in concrete situations.

At this level, students must demonstrate the ability to take information that has been acquired and comprehended and use it in a concrete situation.

Many word problems in elementary school mathematics necessitate Application-level performance. For instance, after teaching your students the mechanics of division, you can use the multiple-choice item to see how they apply what they have acquired and comprehended in the concrete situation of a word problem. You no doubt want to give your students a variety of opportunities to demonstrate their abilities to apply, in concrete situations, all of the mathematical functions that they have acquired and comprehended. Here is one example:

C If Eli bought four Popsicles for a total cost of \$3.00, how much did each one cost?

- A. 25¢
- B. 50¢
- C. 75¢
- D. \$1.00

This is an Application item because the students must use their acquired and comprehended division skills in a concrete situation. The stem of the item presents a clear and distinct problem that is answered by a single, brief and correct response, and the distracters are plausible.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

As an elementary teacher, you are aware of the importance of your students' understanding the relationship among the parts that constitute a mathematical whole, as was discussed in Chapter 3. You can test your students' abilities to perform such tasks with multiple-choice items like the following one using monetary units.

D A dollar bill can be broken down into

- A. two quarters, two dimes, and five nickels.
- B. three quarters, one dime, and four nickels.
- C. one quarter, five dimes, and six nickels.
- D. two quarters, three dimes, and four nickels.

This Analysis-level item requires students to analyze sets of monetary units to identify the one that constitutes a dollar bill. The stem presents a

problem that is answered by the correct option. Note that all of the options are of comparable length.

Science

The natural sciences lend themselves well to both performance-based and paper-and-pencil assessment, and we advocate a combination of the two. Paper-and-pencil assessments do not allow for the in-depth scrutiny provided by performance-based assessments, but they can cover broad latitudes of material. The multiple-choice test allows for effective assessment of the Knowledge through the Analysis levels.

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Remember that regardless of the complexity of a concept, it is confined to the Knowledge level if students are given information to memorize. Case in point: Students usually memorize rather than classify the characteristics of animals according to their respective classes. Here is a sample item to test whether your students know the characteristics of the classes of animals:

 B A mammal does *not*

A. have hair.

B. lay eggs.

C. nurse its young.

D. have warm blood.

Note that the term *not* is italicized to avoid confusion.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

According to the definition, *understanding* is necessary at the Comprehension level. For example, if you tell your students something and they incorporate what you have told them into memory, the information is stored at the Knowledge-level. However, if they read the same information themselves, they must understand what they have read in order to store it in memory. To determine how well your elementary students have understood one of their reading assignments, you can use a multiple-choice item like the following:

B As stated in your text, an example of a carnivore is the

- A. triceratops.
- B. pterodactyl.
- C. brachiosaurus.
- D. brontosaurus.

This Comprehension-level item tests reading comprehension: Students must understand the printed text in order to answer the item. Also, the stem states a problem that is answered by one of the brief options.

Application Level: Students are able to take information that has been acquired and comprehended and use it in a concrete situation.

Sometimes hypothetical situations are necessary precursors to actual situations. For example, as part of a botany unit, you could plan to take your fifth grade class on a field trip. To determine whether your students are ready to apply the information you have given them, you can use a multiple-choice item like the following:

D On a field trip, you enter a large bed of morning star flowers. You should be wary of

- A. black widows.
- B. scorpions.
- C. tarantulas.
- D. ground rattlers.

By presenting a hypothetical situation, you have elevated what could be a Knowledge or Comprehension item to the Application level. The stem of the item is tight and to the point, and the options are brief and contain plausible distracters along with one best answer.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

Within each grade and professional level of the natural sciences we encounter situations that necessitate an understanding of cause-and-effect relationships. To sample how well your students can determine chemical cause-and-effect relationships, you can use a multiple-choice item like the following:

D A reaction occurs through the mixing of vinegar, mouthwash, water, and baking soda. The two primary ingredients causing the reaction are the

- A. vinegar and mouthwash.
- B. water and baking soda.
- C. vinegar and water.
- D. vinegar and baking soda.

To answer this item correctly, students must correctly analyze which mixture produces the reaction (cause and effect). Devoid of excessive information, the stem presents a problem that is answered by the single best option, which is disguised by relatively brief and plausible distracters.

Social Studies

As much as with any other content area, the Knowledge level is prerequisite to higher-order activities in the social studies area. Since much basic information is necessary before your students are able to comprehend, apply, and analyze it, you need to know how much of this basic information they have acquired. The multiple-choice test is an excellent tool because it provides for wide, economical sampling regarding time and space.

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

As an elementary teacher, you want your students to understand the interactions among the three branches of government and that these interactions form a balance of power. Yet before you can guide them to this understanding, they must first know what the three branches are. To sample whether they have acquired this knowledge, you can use the following multiple-choice item or the like:

- D An official branch of the federal government is the
- A. domestic branch.
 - B. foreign branch.
 - C. civil branch.
 - D. judicial branch.

This item involves recognition; it is structurally sound with its proportionately long but succinct stem, short options containing a clearly best answer, and three plausible distracters.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

For instance, you want your social studies students to understand trends in data, a prerequisite to making predictions based on analysis of cause–effect relationships. Much of the social data that you want them to understand is numerical. Knowing that the ability to see continuations in trends of data is a Comprehension-level process, you can use a multiple-choice item like the following to sample whether your students can perform at this level.

A According to the bar graph shown, next year’s school population should be

- A. 600.
- B. 650.
- C. 700.
- D. 750.

In this Comprehension-level item, students must extrapolate to demonstrate their understanding of a data trend. The stem is clear and proportionately long with respect to the brevity of the options, and there is a single best answer.

Application Level: Students are able to take information that has been acquired and comprehended and use it in a concrete situation.

Skills and abilities become more meaningful when used in concrete situations. For example, let us say you have guided your elementary students in the development of their map-reading skills and now you wish to gauge how well they can apply them. To do so, you could use the following multiple-choice item:

A According to the map shown, the distance from Port Arthur to Beaumont is

- A. 18 miles.
- B. 20 miles.
- C. 21 miles.
- D. 23 miles.

This Application-level item requires students to apply their map-reading skills in the solution of a concrete problem. The stem is direct and succinct, the distracters are brief and reasonable, and there is a single best answer. Moreover, there is sufficient room on the test copy for the students’ computations.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast

phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

For example, the emphasis on diversity is prevalent throughout the PreK–12 curriculum. Comparing and contrasting phenomena, such as cultures, is an Analysis-level activity. Let us say you have taught a unit on international holidays in your classroom and wish to see if your students perceive that there are both commonalities and unique differences among holidays celebrated over the world. As a part of your summative assessment, you could construct a multiple-choice item like the following:

- C The greatest similarity between Christmas and Hanukkah is
- A. decorated trees.
 - B. Santa Claus.
 - C. gift exchanges.
 - D. the birth of a Savior.

Analysis-level in that it involves a comparison, this item also requires fine discrimination. The item has a clear and distinct stem that presents a problem answered by a single, short, and best option, which is disguised among three plausible distracters of approximately similar length.

English–Language Arts

The versatility of the multiple-choice item is highly visible in the measurement of student achievement within this content area. It is appropriate for use in the Knowledge, Comprehension, Application, and Analysis levels. Its range includes the knowledge of vocabulary definitions, an understanding of the settings of literary works, the application of grammar and punctuation skills, the perception of symbolic usage, and comparisons between literary works. Moreover, it allows for measurement of these components with economy of time and space.

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

As a means of sampling your students' retention of words from a previous spelling test, you could use a multiple-choice item similar to the following:

- D The correct spelling of our state is
- A. Pensylvania.
 - B. Pennsilvania.
 - C. Pennsalvania.
 - D. Pennsylvania

This Knowledge-level item involves recognition. Moreover, it is clear and succinct and has three plausible distracters and one correct answer.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Understanding something is often situated between factual knowledge of that phenomenon and its application. For example, your students cannot memorize all of the adverbs in the language (Knowledge). Although you may not want your students to use adverbs in sentences (Application) at this point, it is time to determine whether they understand what adverbs are. The following multiple-choice item samples whether your students can distinguish between adjectives and adverbs.

B Which word is an adverb?

- A. Slow
- B. Slowly
- C. Slower
- D. Slowest

This is a Comprehension-level item because the students have *not* memorized this adverb (Knowledge), and they are *not* using the adverb in a concrete situation (Application). The students are demonstrating that they understand what an adverb is (Comprehension). Structurally, the item has a clear and understandable stem, three brief, plausible distracters, and one correct option.

Application Level: Students are able to take information that has been acquired and comprehended and use it in a concrete situation.

The ability to apply the rules of grammar, punctuation, capitalization, and word forms and usage can be measured by multiple-choice items. Moreover, the multiple-choice test provides for broad coverage of these aspects in a relatively short period of time. For instance, as part of a unit on the parts of speech, your students have been working with adjectives and adverbs. To check on their progress, you can use the multiple-choice test for formative assessment. The item below could be a sample from your test:

D In which sentence is the word *good* used correctly?

- A. I did good on my first test.
- B. He speaks good of you.
- C. He runs good.
- D. The cookie tastes good.

Although the short-answer item is probably better for measuring this type of application performance, multiple-choice items allow for a broader sampling in a shorter period of time. This item allows students to apply what they have acquired and comprehended about adjectives and adverbs. The stem is clear, and the distracters are plausible and necessitate fine discrimination, but there is only one best answer.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

Much student involvement in English–Language Arts takes place at the Analysis level, whether with writing or literature. The multiple-choice item is easily adaptable to the measurement of student performance in these areas. For instance, breaking down any written piece of information into its basic parts is an Analysis-level activity. Say you have been working with your students on the construction of friendly letters. To dissect a letter, they must understand the relationships among its parts. You can use multiple-choice items to sample their progress. The following could be one of your items:

- B “Dear Christine,” This part of the letter would be found in the
- A. heading.
 - B. greeting.
 - C. body.
 - D. complimentary close.

Analysis level in that the student is required to categorize, the item presents a clear and distinct problem in its stem. The options are terse, with realistic distracters and a single best answer.

SUMMARY

The multiple-choice test is powerful and versatile, providing for wide coverage in a relatively short period of time and allowing for measurement of both basic and higher-order thinking processes. However, poorly constructed items can negate these strengths. The multiple-choice item is easily adaptable to any content area in the elementary schools and it also provides for measurement at the Knowledge, Comprehension, Application, and Analysis levels.

PROFESSIONAL DEVELOPMENT ACTIVITIES

First, assemble into three- or four-member groups. Once assembled, each group will collectively construct two or three multiple-choice items, in subject

areas of your choosing, within each of the following levels: Knowledge, Comprehension, Application, and Analysis. Before constructing your items, review the “Guidelines for Construction” section of this chapter. Then look over the definitions of the four cognitive levels. Now you are ready to begin the construction of your items.

When you have finished constructing your items, one representative from each group, depending on the size of the chalkboard, will put a Knowledge-level item on the board for discussion and constructive criticism. After these multiple-choice items have been scrutinized, other representatives will put their Knowledge-level items on the board for discussion and criticism. This will continue until there is a consensus to move on to Comprehension. These procedures should progress through the Analysis level.

As you observe the items on the board, first determine whether each item is actually measuring the cognitive level it is intended to measure. To do this, you should reexamine the definitions of the four cognitive levels. Next, you should look to see whether the items are constructed in compliance with the guidelines suggested in the “Guidelines for Construction” section of this chapter.

WWW RESOURCES

<http://artswork.asu.edu/arts/teachers/assessment/forced1.htm>

This Web site of the Arizona State University and the Arizona Board of Regents provides suggestions regarding the strengths, weaknesses, and construction of multiple-choice items.

<http://www.edtech.vt.edu/edtech/id/assess/items.html>

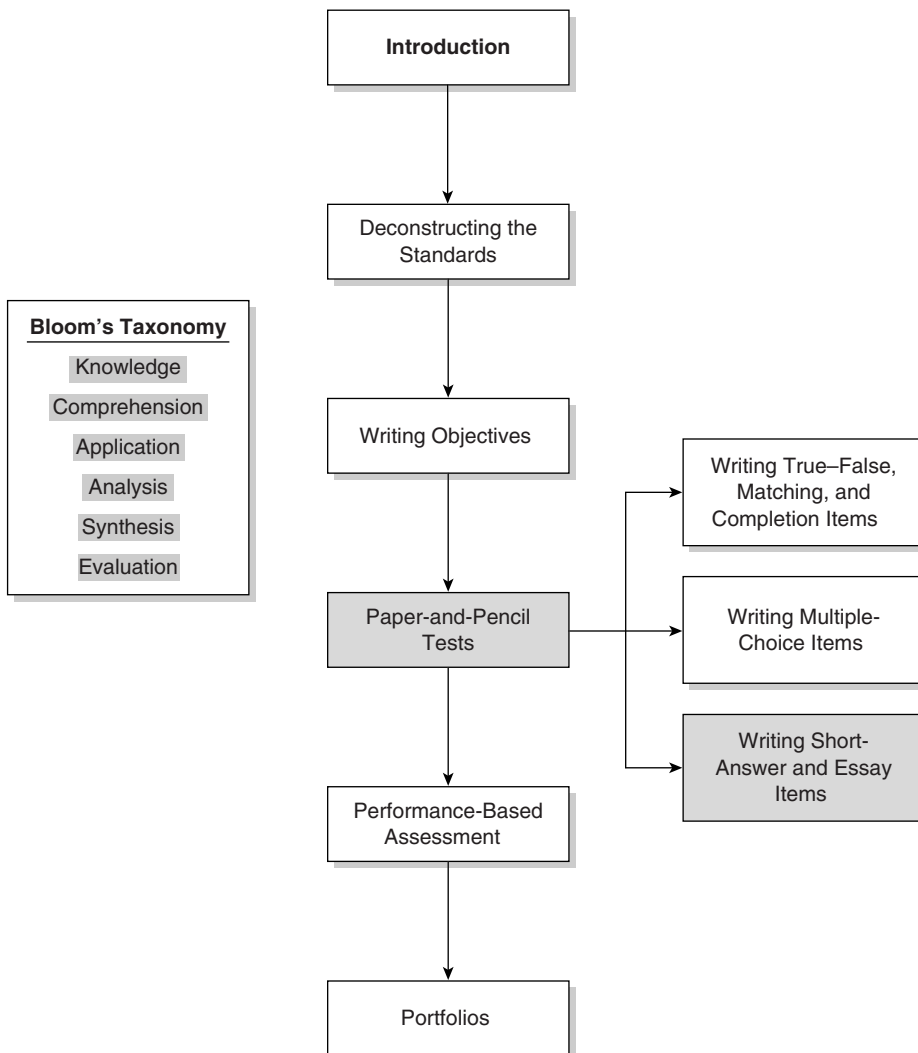
This Web site of The Virginia Polytechnic Institute presents pros and cons of the multiple-choice item, as well as suggestions for its construction.

<http://uwf.edu/atc/assessment/Mult-Choice.cfm>

This Web site of the University of West Florida provides suggestions for writing multiple-choice questions.

5

Writing Short-Answer and Essay Items



INTRODUCTION

The Short-Answer Item

Some measurement specialists equate the **short-answer** with the completion item, perceiving its usefulness as confined to the Knowledge level. Others see no difference between the short-answer and the completion items in either usefulness or structure. As we demonstrate, however, the horizontal versatility of the short-answer item transcends the major content areas, and it is adaptable to every level in the cognitive domain. Since many state assessment tests contain open-ended questions, skill in responding to short-answer items can improve your students' scores on these high-stakes tests.

Structure

As we mention in Chapter 3, the completion item is an incomplete sentence with a single blank at the end of the item. The short-answer item, however, is structured either as a question or a command:

Question: What is the sum of $38 + 24$?

Command: Solve the problem $38 + 24$.

As with the completion item, neither the question nor command form of the short-answer item should provide for multiple answers:

Bad: When did Columbus first come to the New World?

Answer: When Queen Isabella financed his voyage (or, In 1492).

Good: In what year did Columbus first come to the New World?

Answer: 1492

The short-answer item also should be structured to avoid unintentional clues:

Bad: List the three primary colors.

Good: List each of the primary colors.

(The term *each* indicates that all of the primary colors are to be listed, but it does not specify the number of primary colors, thus avoiding an unintentional clue.)

The Essay Item

The **essay item**, in our opinion, is one of the most misunderstood, misused, and abused items within the entire paper-and-pencil domain. It has definite strengths, but it also is prone to pronounced weaknesses, some of which are attributable to the construction and scoring of the item. In this chapter, we show you how to avoid construction and scoring weaknesses.

A primary strength of the essay item is its provision for an in-depth, detailed analysis of a small area of material (Analysis level). This item further permits assessment of students' organizational, creative, and writing skills; their ability to build a case and make a point; and their capacity to evaluate phenomena, all of which occur at the Synthesis and Evaluation levels. Also, it is comparatively easy to construct. However, it is of limited use for assessing broad latitudes of content.

Scoring essay items requires expertise, especially since some students are adept at talking around a point. However, clearly defined items and adherence to corresponding **rubrics**, as we discuss later, will neutralize any diversionary tactics devised by an ill-informed student. Also problematic to the neophyte or inattentive teacher are secondary factors, such as spelling, handwriting, and neatness, but well-constructed rubrics can minimize or even negate such distractions: They can illuminate responses that do not meet specified criteria, regardless of how neat and verbally correct they may be.

As with the short-answer item, student skills in writing essay responses have become increasingly important with the implementation of open-ended questions on statewide examinations. When you know how to construct and score essay responses, aware of the strengths and weaknesses of these items as well which cognitive levels are most conducive to their assessment, the result will be higher student scores on both high-stakes state examinations and on your own tests.

Construction

Following an essay exam, a common answer to the question, "How did you do?" is, "I don't know . . . it depends on what the teacher wants." If this is the response, the items are probably vague, and if students do not understand the question, how can you determine whether they know the answer? Of course, the item should not contain clues to its answer, but it should specify exactly what is expected of the students, so it is important to structure the item to include the specific points that should appear in the students' responses. For example, the item may begin with a task-directed statement:

Within two pages, compare and contrast how George Washington and Francis Marion contributed to the Revolutionary War. In your narrative, cite one similarity and one difference, including two supporting arguments for each. Your essay should be well organized as well as grammatically and linguistically sound.

Beginning with a task-directed statement, this item leaves no doubt as to what is expected of the student.

Scoring

Rubrics should be used to score essay items. Rubrics in this context are scoring guides, delineating a point spread for each item and the bases for awarding the points, including partial credit for partially right responses. In some instances, they are best developed as tests are constructed, although generic rubrics can also be helpful. In either case, they help ensure consistency, objectivity and fairness in scoring, and we strongly advocate their use.

For instance, using the previous example, the cited similarity and difference could each have a zero to three-point value, depending on the selection and presentation. Then the four supporting arguments could have a zero to three-point range, based on their relevancy and significance. Although the item stresses organizational, grammatical, and linguistic soundness, these skills should previously have been taught if they are to have rubric point value. If they have not been taught, they should not be factored into the rubric.

Generic rubrics are appropriate for multiple classroom situations. As Arter and McTighe (2001, p. 27) point out, they are “useful to help students understand the nature of quality—the ‘big picture’ details that contribute to the quality of a type of performance or product.” They go on to explain that “task-specific scoring could happen in mathematics, social studies, science, and any class that has a particular content to be learned (p. 28).” In describing task-specific rubrics, they acknowledge that these rubrics “allow students to see what quality looks like in a simple problem—the one at hand” (p. 27). Such rubrics also provide for analytic scoring.

Although it is cumbersome, we recommend scoring essay tests item by item as opposed to paper by paper. This strategy assists you in focusing on a specific area, allowing you to detect patterns in student responses (e.g., a number of students omitting the same point), which may indicate the need to adjust your instruction or the item itself. The item-by-item method also allows you to score the papers more anonymously; you are assessing responses rather than students, thus negating the halo effect. For example, if Fred has previously performed well, you may assume that he is going to

perform well on this particular assignment and thus award him undeserved points. Of course, with the scoring of any test—and especially the essay test—if you become tired, stressed, or hungry, stop immediately and do not resume until you have regained homeostasis.

SHORT-ANSWER ITEMS, CONTENT AREAS, AND COGNITIVE DOMAIN LEVELS

In the following examples, we demonstrate that the short-answer item is adaptable to each of the cognitive hierarchical levels within the major content areas. As in Chapters 2, 3, and 4, we start with a brief statement of the defining characteristics for each cognitive level in each content area.

Mathematics

Knowledge Level: Students can recognize and recall information; no comprehension or understanding of information is expected.

To determine your students' knowledge of their multiplication facts, you can use short-answer items such as the following:

What is the product of 9×7 ?

Answer: 63

Knowledge-level in that it tests rote memorization, this item is brief, direct, gives no clues, and provides for a single answer.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Here is an example: A rearrangement of the addends in a problem does not change the sum. Demonstrating an understanding of this concept is a Comprehension-level activity. You could use a short-answer item such as the following to measure such understanding.

$9 + 4 = 13$. What is the sum if the addends change places? Show your work.

Answer: $4 + 9 = 13$

This is a Comprehension-level item in that the students must understand that both $9 + 4$ and $4 + 9$ equal 13. With a well-constructed item, students can

learn while responding to it; if they hadn't realized this principle beforehand, they can see how it works in this instance. Furthermore, the item provides for one answer but gives no clues to it.

Application Level: Students are able to take information that has been acquired and comprehended and use it in concrete situations.

For instance, during a multiplication unit, you can determine the extent to which your students can apply what they have learned to concrete situations. A short-answer test like the following is excellent for making this determination.

If pizzas cost \$6.25 each, how much would six pizzas cost? Show all of your work.

Answer: $\$6.25 \times 6 = \37.50

By using the principles of multiplication to solve a word problem, students have performed an Application-level process. This problem is direct and succinctly stated and provides for a single correct answer.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

To determine whether your students can divide a monetary whole into parts, the short-answer item is a suitable tool. For example,

Break one dollar into pennies, dimes, and quarters.

Acceptable answers: 3 quarters, 2 dimes, and 5 pennies; 2 quarters, 4 dimes, and 10 pennies, and so on.

This item involves convergent thinking, which is thinking that leads to conventionally accepted best answers (e.g., $3 + 1 = 4$, $2 + 2 = 4$). It is an Analysis-level item because the students are presented with a whole that they must break down into three denominations; they must understand the relationships among pennies, dimes, and quarters.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems. Many Synthesis-level processes involve divergent thinking, which is thinking that can travel in many different directions, with no predetermined single correct answer. This is not to

imply that there are no item guidelines or that all student responses are acceptable. The item should clearly and succinctly specify what is expected of the student.

Here is a sample short-answer item to test your students' ability to assemble parts into a new whole:

Construct and solve a word problem that calls for the multiplication of dollars and cents.

Possible answer: If one pizza costs \$6.25, how much do three pizzas cost? $\$6.25 \times 3 = \18.75

This is a Synthesis-level item because the student must assemble parts into a new whole. It is clear in its specification of what is expected of the student, yet it furnishes no unwarranted clues. In your rubric, you can decide to award five points for the multiplication of dollars and cents and up to three points for the correct answer (\$18.75). Obtaining the correct answer (Application) is worth fewer points because the emphasis here is on Synthesis rather than Application.

Evaluation Level: Students are able to make value judgments based on predetermined criteria or internal consistency. Remember that predetermined criteria are often personal, based on likes, dislikes, strengths, weaknesses, and so forth, meaning that there can be no predetermined correct answer. Rather, the correctness of an answer must be assessed according to the supporting rationale.

Since many math problems can be solved in more than one way, you can give your students options for solving a problem and allow them to choose and support their choices. The short-answer item is a suitable vehicle for this purpose, as the following example shows:

How would you determine how many students are in a classroom having six rows with four students in each row? Would you multiply the number of rows by the number of students per each row? Would you count the number of students in each row and add the number of rows? Would you count all of the students individually? Would you use another method? Explain the reason for your decision.

Possible answer: I would count all of the students one by one so I would be sure not to miss anyone. I am better at counting than I am at adding and multiplying.

This is an Evaluation-level item because the student must make a choice on the basis of perceived strengths and personal appraisal of the

situation. It is your responsibility to assess the response not so much on the basis of the choice per se, but rather on the rationale justifying the choice. The sample student response is an indication that the student needs assistance with addition and multiplication skills. The rubric could allow a maximum of three points, depending on the explanation.

Science

Knowledge Level: Students can recall information; no comprehension or understanding of information is expected.

To sample your students' knowledge of our solar system, for instance, a short-answer test is an adequate device:

Write the name of the largest planet in our solar system.

Answer: Jupiter

This Knowledge-level item, involving recall, is in the form of a command, supplying no clues and providing for a single answer. You can decide whether or not to factor spelling into the correct answer.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Since translating information from one form to another is a component of Comprehension, you can use the short-answer test to sample your students' understanding of synonyms. For instance,

What is another term for *tsunami*?

Possible answer: Tidal wave

Comprehension-level in that it asks for a different form of a term, this question-form short-answer item is direct and provides for a correct answer without furnishing unnecessary clues.

Application Level: Students are able to take information that has been acquired and comprehended and use it in concrete situations.

As an example, during a unit on measurement, you may want your students to convert metric to English units, and vice versa. Remember, conversions do not simply involve translating information from one form to another; they necessitate the *application* of formulae. An item like the following is a means of measuring the students' ability to perform this action.

How many miles equal seven kilometers? Show your work to the nearest one-hundredth.

Answer: 1 mile = 1.61 km

$$7 \text{ km} / 1.61 \text{ km} = 4.34 \text{ mi}$$

Application-level in that it requires the application of a formula, this item is brief, to the point, and specifies exactly what is expected (“to the nearest one-hundredth”). You can determine whether partial credit may be earned.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

The ability to compare and contrast phenomena is an Analysis-level competency. A short-answer item such as the following can sample your students at this level.

List three similarities and three differences between a cat and a rabbit.

Possible answer:

Both are mammals.	A cat is a carnivore, and a rabbit is a herbivore.
Both have a brain.	A cat walks, and a rabbit hops.
Both have blood.	A cat has short ears, and a rabbit has long ears.

There are many combinations of similarities and differences; it is your responsibility to determine whether the listed characteristics are correct.

Synthesis Level: Students are able to demonstrate the ability to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems. Many Synthesis-level processes involve divergent thinking, which is thinking that can travel in many different directions. For items testing at this level, there can be no single correct answers. This does not indicate, however, that there are no guidelines or that all student responses are acceptable. Indeed, the item should clearly and succinctly specify what is expected of the students.

As part of an ecology unit, you could use short-answer items to sample your students’ ability to enhance their immediate environment; for instance,

List two *original* ways that you can contribute to the school’s recycling program.

Possible answer:

1. Make posters at home to place around the school.
2. Ask friends and family members to save their recyclables so that I can contribute them to the school's program.

This item solicits the students' creative efforts in a direct and terse manner. In your rubric, you could allow for a maximum of three points for each suggestion, depending on logic and originality.

Evaluation Level: Students are required to make value judgments based on predetermined criteria or internal consistency. It should be remembered that predetermined criteria are often personal, based on likes, dislikes, strengths, weaknesses, and so on. Hence, there can be no predetermined correct answer, and the correctness of an answer should be assessed according to the supporting rationale.

Whenever you are assessing student responses, you must maintain your objectivity: Concentrate on the logic of the students' rationale for their respective positions, as opposed to the positions themselves. For example, after a unit on the relationship between the environment and industry, items like the following are suitable to assess students' positions on controversial environmental issues:

Do you believe that oil drilling should take place in Alaska? List three (3) reasons to support your position.

Possible answer: No, because

1. there are endangered species there;
2. it will ruin the beauty; and
3. we don't really need the oil.

This is an Evaluation-level item because it calls for a value judgment. It is objective in that it elicits the students' respective positions without leading them. Again, however, you must assess the students' rationale rather than their positions. For example, even though you may agree with a student's position, you must concentrate on the rationale, especially since this is a short-answer item, and students cannot go into great detail. However, the answer could mention which species are endangered, how drilling would ruin the beauty, and why we really don't need the oil. You could allow a maximum of three points for each supportive reason and five points for their continuity.

Social Studies

Knowledge Level: Students can recall information; no comprehension or understanding of information is expected.

As a means of determining your students' knowledge of the three branches of the federal government, you could use a short-answer item such as this one:

What are the names of the branches of the federal government?

Answer: Executive, Legislative, Judicial

Knowledge-level involving rote memorization, this item uses the definite article *the* to avoid an unintentional clue through use of the term *three*, while simultaneously providing for a specific answer.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

The ability to summarize is a component of the Comprehension level. An item like the following can sample your students' understanding of historical events, as evidenced by their summaries.

Why did John Alden speak to Priscilla about marriage?

Answer: Because Miles Standish ordered him to do so.

This is a Comprehension-level example not only because it requires understanding on the part of the students but it also because calls for them to summarize that understanding. The item is direct and provides for a correct answer without supplying the examinee any clues.

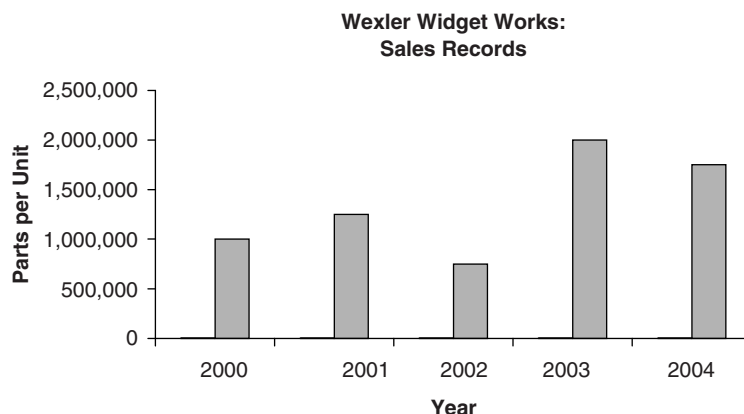
Application Level: Students are able to take information that has been acquired and comprehended and use it in concrete situations.

The ability to read and interpret charts is an essential component of many social studies areas. An item like the following is a useful vehicle for these interpretive exercises.

According to the bar graph shown, how many widgets were sold in 2000?

Answer: One million

This is an Application-level item because students must apply the skills that they have acquired and comprehended in a concrete situation. You can decide whether to award points for answers that are not exact.



Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

Short-answer items are excellent vehicles for sampling students' ability to compare and contrast, which is an Analysis-level endeavor. For instance, during a unit on agriculture in the United States, you might use the Amish as a comparative example of the way farming used to be, and the following could be a sample test item:

List three differences and three similarities between Amish farming and current modern farming.

Possible answer:

Amish use horses, and modern farmers use tractors.	Both plant and harvest.
Amish milk by hand, and modern farmers use electric milkers.	Both help their neighbors.
Amish do not have electricity in their homes or farms, but modern farmers do.	Both are affected by the weather.

With its instruction to compare and contrast two phenomena, this is an Analysis-level item. Although there are similarities and differences other than those cited in the example, the item is objective and involves convergent thinking (thinking that leads to conventionally accepted best answers). In addition, the item is clear and distinct, providing for a correct answer without furnishing clues.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems. Many Synthesis-level processes involve divergent thinking, which is thinking that can travel in many different directions, with no single correct answers. This is not to imply that there are no item guidelines, however, or that all student responses are acceptable. Indeed, the item should clearly and succinctly specify what is expected of the students.

For instance, you could effectively use a short-answer item to sample your students' proficiency in resolving conflicts between peers:

Two friends visiting you for the afternoon cannot agree on a recreational activity; one wants to bicycle and the other wants to play computer games. Within *two* sentences, explain how you would resolve this conflict.

Possible answer: Set aside equal time for each activity, and toss a coin to see which activity would be first.

In this Synthesis-level item, students must direct their creative ideas toward the solution of a problem. The item specifies what is expected of them without furnishing any clues for correct answers. As with most Synthesis-level items, there is a multiplicity of right answers. In your rubric, you could allow up to five points for the item, depending on logic, potential effectiveness, and originality.

Evaluation Level: Students are required to make value judgments based on predetermined criteria or internal consistency. Remember that predetermined criteria are often personal, based on likes, dislikes, strengths, weaknesses, and so on, and there can be no predetermined correct answer. Rather, the correctness of an answer should be assessed according to the supporting rationale.

Value judgments regarding the ideal qualities of a U.S. president are long-standing. After a unit on presidential qualities, for instance, a short-answer item could assess your students' judgments of them:

List the three (3) qualities that you think are most important for a U.S. president, and give one reason for each of your choices.

Possible answer:

1. Honesty, because the people should be able to trust the president.
2. Concern for all the people, because some people are weaker than others.
3. Communication skills, because the president must make his or her ideas understandable.

This is an Evaluation-level item because the student has made a value judgment. Since there is no predetermined correct response (scholars cannot even agree on the qualities), you must score the student on the written rationale. As a suggestion, you could allow for a maximum of three points for each reason, depending on the duties of the presidency, and three points for consistency among the three reasons.

English–Language Arts

Knowledge Level: Students can recall information; no comprehension or understanding of information is expected.

A short-answer test can sample your students' knowledge of the different parts of speech. For example,

Write the definition of a noun.

Answer: A noun is a word that names a person, place or thing.

Knowledge-level involving a definition, this item specifies what is expected of the students without presenting unwarranted clues.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

In many instances, you will want to assess your students' comprehension of a reading assignment. The short-answer test is an excellent device for making these assessments.

How were Maniac McGee's parents killed?

Answer: In a train wreck.

This question-form item does not sample students' analytical abilities: It simply samples their comprehension of material covered in the text. The question is brief and clear and provides for one correct answer without providing any clues.

Application Level: Students are able to take information that has been acquired and comprehended and use it in concrete situations.

Following a unit on sentence types and structure, you could give your students the opportunity to apply what they have learned by writing examples of the different sentence types. For example,

Write a declarative sentence. Do your best with respect to spelling, grammar, punctuation and capitalization.

Answer: Harrisburg is the capital of Pennsylvania.

Although the directions instruct students to do their best with respect to the intricacies of the sentence, you must decide if or precisely how general mechanics will factor into the total points.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

Student understanding of information given in a literary selection is usually a Comprehension-level achievement (e.g., the setting of a novel). However, understanding acquired through students' logical reasoning is an Analysis-level accomplishment (e.g., determining the plot or the theme of a novel). You can sample your students' ability to analyze assigned literature selections. For instance,

What was Charlotte's purpose in writing "web messages?"

Answer: To save Wilbur.

In this Analysis-level item, students must determine a cause–effect relationship that is not directly cited in the book. Also, the item is direct and calls for a single answer; it could vary in the way it is phrased, but it remains a single, correct answer that must be obtained without the assistance of unintentional clues.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems. Many Synthesis-level processes involve divergent thinking, thinking that can travel in many different directions, with no pre-determined single correct answer. This is not to imply that there are no item guidelines, however, or that all student responses are acceptable. Indeed, the item should clearly and succinctly specify what is expected of the student.

Assembling parts into a new whole is a Synthesis-level activity. You can use the short-answer item to determine the extent to which your students can assemble a conglomeration of words into a mechanically and grammatically correct sentence. For instance,

Construct a sentence using each of the following words.

for	Shasta	run
go	will	
tomorrow	a	

Possible answer: Shasta will go for a run tomorrow.

This is a Synthesis-level item because it requires the student to assemble disjointed parts into a whole. Since these words can correctly be assembled in a number of ways, you could allow a maximum of five points for using all of the words, up to two points for grammatical and mechanical usage, and as many as three points for originality.

Evaluation Level: Students are required to make value judgments based on predetermined criteria or internal consistency. Remember that predetermined criteria are often personal, based on likes, dislikes, strengths, weaknesses, and so on, and there can be no predetermined correct answer. Rather, the correctness of an answer should be assessed according to the supporting rationale.

To determine your students' evaluation of their literary assignments, the short-answer item is an excellent choice. For example,

Do you think it is believable that a young boy like Mullet Fingers could live alone in a Florida swamp? List three (3) reasons for your position.

Possible answer: Yes

1. He was smart.
2. He was not afraid.
3. He had good coordination.

This Evaluation-level item requires a value judgment of the student based on personally predetermined criteria. Since this is a short-answer rather than an essay item, it precludes a detailed analysis. However, you should assess the student's response not according to whether you agree with the student's position but rather on the strength of the rationale. As a suggestion, you could allow a total of four points for each reason, depending on its coincidence with the book and general logic and rationale.

ESSAY ITEMS, CONTENT AREAS, AND COGNITIVE DOMAIN LEVELS

A well-constructed essay item allows for an analytic examination of task-specific assignments, and it serves as a vehicle for the assessment of both creative and persuasive expression at the Analysis, Synthesis, and Evaluation levels. (To assess performance at the Knowledge, Comprehension, and Application levels, we recommended that you select from among the previously discussed test items.)

Mathematics

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among the parts, determine cause-and-effect relationships, understand analogies and metaphors, and categorize phenomena.

You can use the essay item to good effect to determine whether your students can separate a specific monetary whole into parts and also to monitor the extent to which they can explain this process. For example,

Divide a dollar bill into pennies, nickels, dimes and quarters. Be sure to use each of the coins and explain how your combination equals one dollar.

The demands of this item are twofold: (1) to break the dollar into four denominations and (2) to explain how they combine to equal one dollar. The rubric for this item should first address whether all of the denominations have been used accurately to equal one dollar, and then assess the students' explanation of the relationships among the denominations.

The rubric should include a maximum and minimum value for each of the parts. For example, you could allow a maximum of two points for using four denominations, two points for totaling one dollar, two total points for the explanation, and two points for clarity.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

The essay item is an excellent means of assessing your students' creative applications of arithmetical principles. For example,

You have \$50.00 to plan a pizza party for eight people. Explain which items you will purchase and the individual cost for each item. Also, you must (1) spend as much of the \$50.00 as possible but not exceed that amount, (2) multiply at least three times, (3) subtract or add if needed, (4) show all of your work, and (5) explain in detail the purpose of each of your mathematical operations.

This is a Synthesis-level item, involving a plan of action and assembling parts into a monetary whole. For the rubric, you could determine a maximum of two points for the purchase of each item; one to five points for arriving between five dollars to less than one dollar of the given amount; one to three points for each explanation of the mathematical processes; and as many as five points for overall organization, clarity, accuracy and detail.

Evaluation Level: Students should be able to make value judgments on the basis of predetermined criteria or internal consistency.

In many instances, several mathematical operations may be used to solve the same problem. Hence, the process of selection becomes a value judgment, often based on the students' perceived skills, time, and so forth. Acknowledging this, you may decide to give your students different options for solving the same problem and then assess them according to their rationale. The essay item is an excellent means of such assessment. Here is an example:

You are to determine the number of balls depicted in the following graphic. There are several ways to go about it; for example, by addition, multiplication, or individual counting.

○ ○ ○ ○ ○ ○
 ○ ○ ○ ○ ○ ○
 ○ ○ ○ ○ ○ ○
 ○ ○ ○ ○ ○ ○

Select one method, and within two paragraphs, explain which one you chose and include two reasons for your choice. You will be assessed on the reasoning supporting your choice and the organization of your explanation.

This Evaluation-level item calls on the students to select a mathematical operation using their own criteria. Since this is a value judgment, gear your task-specific rubric toward the rationale rather than the choice of the operation. For example, you could establish a maximum of five points for each reason; up to four points for the organization of the response; and a total of three points for a combination of grammar, mechanics, and spelling.

Science

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among the parts, determine cause-effect relationships, understand analogies and metaphors, and categorize phenomena.

To find out whether your students can determine the causes of observed reactions between chemical components and whether they can explain these reactions, an essay item such as the following is an excellent approach.

Yesterday's lab experiment involved a demonstration in which a reaction occurred within the mixture of water, baking soda, instant ice tea, and vinegar. In one paragraph, explain which interaction caused this reaction and why.

This Analysis-level item calls for the detection and explanation of a cause-effect relationship. Its rubric should include points for identifying the two compounds whose interaction caused the reaction and have maximum and minimum point values for the explanation.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Recycling, as a means of taking care of the environment, is an important concept within most science curricula. An item like the following can assess your students' ability to construct creative contributions in this arena.

In no more than two paragraphs, discuss how you could reuse an old milk carton as opposed to throwing it away. In your discussion, explain in detail (1) how you would use it and (2) how you would modify it for use.

This Synthesis-level item requires students to (1) create a use for the milk carton and (2) modify it for use. Its preciseness makes for an easily constructed rubric. For example, you could allow from one to three points for the idea, depending on originality and detail; one to three points for the plan for modification, depending on originality and detail; and one to three points for overall organization and clarity of explanation.

Evaluation Level: Students should be able to make value judgments on the basis of predetermined criteria or internal consistency.

Many theories have been formulated in response to some of nature's unanswered questions, and value judgments are often the basis of positions either supporting or opposing them. An essay item like the following can assess your students' reasoning for their individual support of one of these theories.

You have read several different theories regarding why dinosaurs became extinct. In two or three paragraphs, explain which theory you think is most accurate. In your explanation, include three points from any of the assigned readings that support your position. You will be assessed on the clarity, logic and organization of your explanation.

Evaluation-level in that it requires a value judgment supported by the assigned readings, this item is clear in its instructions to the students, thus providing for a task-specific rubric. For example, a maximum of four points could be predetermined for each of the three supporting reasons and as many as seven points for clarity, logic and organization, depending on accuracy and detail.

Social Studies

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among the parts, determine cause–effect relationships, understand analogies and metaphors, and categorize phenomena.

An understanding of cause–effect relationships is a component of the Analysis level, and you could use an item like the following to assess your students’ understanding of how past events can affect present life.

Within two paragraphs, discuss how slavery has affected the United States today. In your discussion, include three specific changes that are direct results of this event.

Analysis-level in that it necessitates the understanding of cause–effect relationships, this item sets the tone for an essay response with “Within two paragraphs,” and reinforces it with “In your discussion.” The item is clear in its instruction calling for “three specific examples.” For the rubric, we suggest that each mentioned change have a value of one to three points, depending on accuracy, significance and presentation.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Here is a sample item that could assess your students’ ability to formulate plans for assisting the needy.

Within two pages, describe how you would organize a group of your classmates and friends to assist the elderly on selected weekends. Explain in your description (1) three tasks that you would offer to perform for these people, (2) how you would coordinate your team members to perform these tasks, and (3) how you would obtain the permission, equipment and transportation necessary for these tasks.

Synthesis-level in that it requires a plan of action, this item is specific in its task direction. For your rubric, you could establish a maximum of five points for the description of the organization of classmates and friends; three points for the appropriateness of each of the three tasks; three points for the explanation regarding the coordination of the team; three points for the description pertaining to the procurement of necessary permission, equipment and transportation; and three points for overall organization and clarity.

Evaluation Level: Students should be able to make value judgments on the basis of predetermined criteria or internal consistency.

In a unit on government, an essay item like the following could assess your students' ability to evaluate elected officials on the basis of the students' personal, well-researched criteria, as opposed to their emotional evaluations.

Within four paragraphs, explain which of the U.S. presidents that we have studied was, in your opinion, the most effective. In your essay, include his performances in the areas of (1) the economy, (2) social programs, and (3) foreign policy. You will be assessed on the logic and presentation of your explanations and on the overall organization of your essay, and you will also be assessed on your grammar, sentence structure, capitalization and spelling.

This Evaluation-level item instructs the student to weigh effectiveness. The rubric could allow for a maximum of five points for each of the specified areas, four points for overall logic and continuity, and three points for grammar and general usage.

English–Language Arts

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationships among the parts, determine cause–effect relationships, understand analogies and metaphors, and categorize phenomena.

Good literature must be analyzed, in that readers must go beyond the information that is directly communicated to them in the text. You could use an item like the one that follows not only for assessment but also as a self-instructional device, because an item that is clear and definite in its task direction compels the students to examine the material in a new way.

Describe in detail, within three paragraphs, the climax of *Walk Two Moons*. In your explanation, include the place, three of the primary characters involved, and what was revealed.

This Analysis-level item motivates the students to categorize or classify information: understanding the definition of a literary climax, they must scrutinize the text to detect the exact scene described. The rubric could provide for a zero to four-point range for the explanation, depending on correct identification and descriptive detail; one point each for mention of the three primary characters (less one point for each character not involved); and zero to five points for the explanation of what was revealed, depending on accuracy and detail.

Synthesis Level: Students are able to assemble parts into a new whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Here is an example of an essay item to assess students' creative skills:

In two paragraphs, write a different ending to *A Long Way From Chicago* that involves Joey, Mary, Alice, Grandma, and one of the Cogill boys. You will be assessed on the originality of your ending, the inclusion of each of the characters, and grammar and spelling.

Synthesis-level with its instruction for coming up with a new solution, this item communicates what is expected of the students while evoking their creativity. In the rubric, you could predetermine five points for the originality of the ending, as many as three points for the treatment of the four people, three points for grammar, and two points for spelling.

Evaluation Level: Students should be able to make value judgments on the basis of predetermined criteria or internal consistency.

You can use an essay item effectively to assess your students' comparative evaluations of their assigned literature selections. For example,

Explain within three paragraphs whether you think *The Adventures of Tom Sawyer* or *Where the Red Fern Grows* better reflects traditional rural values. In your explanation, include three examples from the book that support your position. You will be assessed on the organization, logic, and clarity of each of your supporting reasons; the overall clarity and organization of your explanation; and your grammar, spelling, and general structure.

Involving a value judgment, this Evaluation-level item clearly conveys what is expected of the student. For the rubric, you could assign a total of six points for each of the three supportive reasons, depending on logic, organization, and clarity of detail; five points for the overall organization, continuity and clarity of the essay; and five points for grammar, spelling and general usage.

CHAPTER SUMMARY

Short-Answer Item

Some measurement specialists equate the short-answer with the completion item, perceiving each as confined to the Knowledge level, and some make no distinction between the structures of the two items. As we have demonstrated, however, the short-answer item can be an effective vehicle for measurement in each of the cognitive levels within the major content areas. Either as a question or a command, this item is a useful device for measuring both convergent and divergent thinking. The items must indicate exactly what is expected of the students, however, so that you are confident that the students' responses are true indicators of what they actually know. Nevertheless, as always, the items should contain no hints or clues to the correct answers.

Essay Item

The essay item has definite strengths as well as pronounced limitations. A primary strength is its allowance for a detailed, in-depth analysis of a small area of focus. Moreover, it permits the assessment of the students' analytical, organizational and creative skills. Hence, the item should be employed at the Analysis, Synthesis and Evaluation levels, leaving assessment at the first three levels to some of the other types of test items. If you wish to cover broad areas of material, forgo the essay item in favor of one of the other types, especially the multiple-choice item, if it is your intent to test students at the Knowledge, Comprehension, Application or Analysis levels.

As always, the item should specify precisely what is expected of the students to ensure that they understand what is expected of them; it also makes for an easily constructed and task-specific rubric. Even with clearly defined rubrics, it is important that you grade essays item by item as opposed to paper by paper. With this procedure, you are grading the papers more anonymously—grading papers rather than people.

PROFESSIONAL DEVELOPMENT ACTIVITIES

1. Divide into groups according to content areas. After reviewing the guidelines for constructing the short-answer item, review the definitions of the cognitive levels. Now collectively construct a short-answer item in your content area for each of the following levels:

- a. Knowledge
- b. Comprehension
- c. Application
- d. Analysis
- e. Synthesis
- f. Evaluation

Compare your items with those in the chapter. Then have members from all the groups put their Knowledge-level items on the board for discussion. When you have completed the discussion, follow the same procedure for the remaining five levels.

2. In content-area groups, review the guidelines for constructing the essay item and review the definitions of the cognitive levels. Now collectively construct an essay item in your content area for each of the following levels:

- a. Analysis
- b. Synthesis
- c. Evaluation

Be sure to construct task-specific rubrics for each item. Compare your items with those in the chapter. Have members from each group put their Analysis-level items on the board for discussion. When you have completed the discussion, follow the same procedure for the Synthesis and Evaluation levels.

WWW RESOURCES

http://www.ferris.edu/fctl/Teaching_and_Learning_Tips/Writing%20Tests/WritingEssayTests.htm

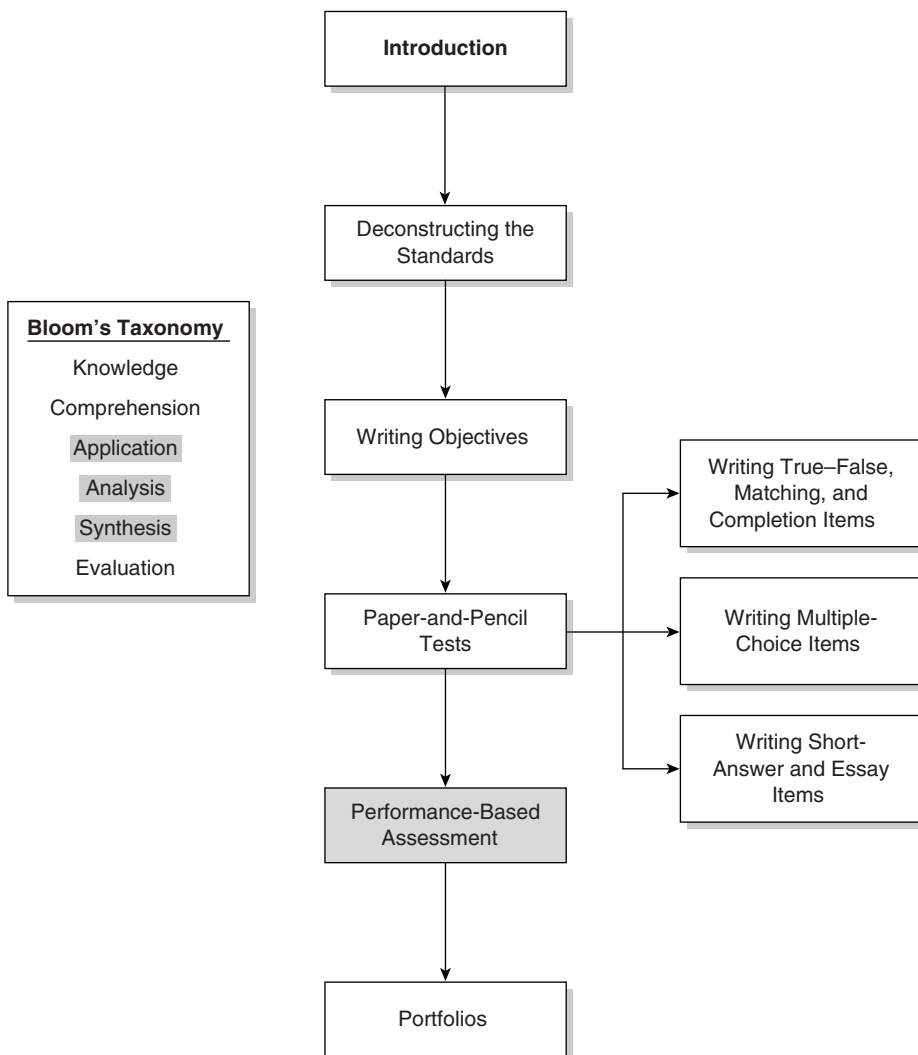
This Ferris State University Web site discusses the advantages and limitations of essay tests and how to use them effectively.

http://www.cidde.pitt.edu/fds/lrn_assess_essay_item.htm

This Web site from the Center for Instructional Development & Distance Education gives suggestions for writing essay questions.

6

Performance-Based Assessment



Despite the power and versatility of paper-and-pencil tests, they cannot assess certain areas of pupil performance. For example, a student can write a description of a lab demonstration, list the steps for setting up a VCR for use, and explain the Heimlich maneuver, but the actual execution of these tasks can be appraised only through performance-based assessment (Application), and such assessment can be applied to both processes and products of performance: *processes* are ongoing procedures leading to a final result, such as collecting sources and writing rough drafts enroute to a finished paper, whereas *products* are the culminating results accomplished through a series or sequence of procedures. For example, after deciding on a topic, your student will probably construct an outline describing the contents of a proposed paper (Synthesis). After you have returned the outline, the student would most likely write more than one draft before completing the paper. The outline and drafts are process procedures, and the final paper is the product.

Some student performances are restricted to one day, while others are extended over a span of time. A restricted performance is specifically defined and can be accomplished and observed during a single session, such as taking a wire, a light bulb, and a battery and then connecting them so that the bulb lights (Application). An extended performance may take several days, or even longer, such as collecting and assembling plant parts for a classification display.

Many performance activities provide for the assessment of behavior that cannot be evaluated by paper-and-pencil tests, but the reliability (consistency of performance) and validity (actually measuring what you want them to measure) of these performances are sometimes difficult to determine. Hence, it is imperative that the purpose of the performance be established beforehand, along with whether it is to be restricted or extended and whether the emphasis is centered on process or product. Furthermore, you should specify exactly which materials, resources, and equipment are to be used. Most important are clearly defined expectations of your students' performances (see Chapter 2), because a high level of clarity is conducive to your students' understanding of what is expected of them, and it also makes for the easy construction of effective rubrics: The more clearly defined and focused the description and directions, the more effective the rubric as an assessment device. As mentioned in Chapter 5, generic rubrics serve a number of purposes. Yet since the performances in this chapter are in compliance with daily instructional objectives, they require analytical or task-specific rubrics.

CHECKLISTS AND RATING SCALES

Checklists and rating scales can assess your students' performances. A **checklist** usually provides for yes-no classifications:

Satisfactory = 1; Unsatisfactory = 0.

Yes = 1; No = 0.

A **rating scale** is a kind of continuum, usually ranging from zero to three, four, five, six, or seven:

3 = Always or very frequently

2 = Most of the time

1 = Sometimes

0 = Never

Regardless of whether you elect to use a checklist or a rating scale, the points that you award should be based on (1) performance objectives and (2) observable indicators.

Poor Checklist Objective: Students will know about the uniqueness of fingerprints. Yes = 1; No = 0

Since this objective does not provide for the observation of student behavior, you would probably have difficulty in accurately assessing your pupils' knowledge.

Good Checklist Objective: Presented with a blotter containing the index fingerprints of two classmates, students will list two differences between the two (Analysis). Satisfactory = 1; Unsatisfactory = 0

Since this objective clearly specifies the desired performance, you are easily able to make an accurate assessment of your students' performance.

Poor Rating Scale Objective: Students will know the exports of given South American countries.

Very Well = 5 points

Well = 4 points

Fairly Well = 3 points

Not Very Well = 2 points

Poorly = 1 point

Very Poorly = 0 points

This objective does not specify how you are to determine the extent to which your students “know” (a very nebulous term) the exports of South American countries. Moreover, the entire rating scale is open to a multiplicity of interpretations.

Good Rating Scale Objective: As an Internet assignment, students will each research a South American country and list at least seven of that country’s imports, with a Web site source (Application).

7 = 5 points

6 = 4 points

5 = 3 points

3 – 4 = 2 points

1 – 2 = 1 point

0 = 0 points

Since this objective specifies the exact number of points to be awarded for correct list items, you will have no difficulty in accurately assessing your students’ performances.

Holistic Scoring

There are instances when you may wish to implement holistic scoring, a procedure in which an overall score is assigned to the total performance, whether it is a project, a presentation, a paper, or whatever. Borich and Tombari (2004) use the following model as an example of a holistic rubric (see Table 6.1). A gymnastics judge may assign a score of 1–10 for a gymnastics performance. This type of assessment is known as *subjective scoring* because the single, awarded score represents multiple movements performed by the gymnast. Similarly, a teacher may assign a rubric score of 6 to a student’s original poem, even though the poem is the product of a number of separate efforts. As Arter and McTighe (2001) mention, holistic scoring provides a “quick snapshot of overall status or achievement” (p. 25). However, they continue by acknowledging that analytical scoring is more detailed and specific.

Analytic Scoring

Analytic scoring is much more detailed than holistic scoring, lessening the opportunities for scoring biases. Remember, clearly defined performance

Table 6.1 Sample Grades and Categories for a Holistic Rubric

<i>Rubric Score</i>	<i>Grade</i>	<i>Category</i>
7	A+	Excellent
6	A	Excellent
5	B+	Good
4	B	Good
3	C+	Fair
2	C	Fair
1	D	Needs Improvement

Source: Borich and Tombari (2004, p. 217)

expectations (objectives) are conducive to detailed and clearly defined rubrics. As the examples in this chapter demonstrate, analytic scoring is better suited to more precise assessment of student performances in the classroom. The following noneducational example parallels the type of rubric that you could use for a classroom performance.

Ms. Garcia and her son, Hector, agreed that Hector should assume responsibility for the family's dog. Ms. Garcia constructed the following weekly chart that includes wages that she chose arbitrarily, as if Hector were being paid. The two thought that Hector could use a couple of the scored weekly charts as references for future pet care jobs.

Table 6.2 represents the total amount Hector could potentially earn in a week. Table 6.3 shows the total amount Hector earned for the week of February 8–14, 2009.

Although Hector's first week's performance was satisfactory, he and his mother feel that he can do better. He may later use his scored assessment, along with an improved future performance, as a process-oriented reference.

Performance-based assessments certainly have drawbacks and limitations: They often lack the reliability and validity found in paper-and-pencil tests, they are time-consuming, they often involve groups as opposed to individuals, and they lack the generalizability of traditional

Table 6.3 The Amount Hector Actually Earned In One Week

February 8–14, 2009														
	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Feed	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30
Water	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30	\$0.30
15–20 min. walk	\$0.50				\$0.50	\$0.50		\$0.50				\$0.50		\$0.50
10–14 min. walk		\$0.30	\$0.30					\$0.30	\$0.30			\$0.30		
5–9 min. walk				\$0.10			\$0.10				\$0.10		\$0.10	
Groom	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15	\$0.15
Total possible per day		\$3.30		\$3.30		\$3.30		\$3.30		\$3.30		\$3.30		\$3.30
Total earned per day		\$2.30		\$1.90		\$2.50		\$2.10		\$2.10		\$2.10		\$2.10
Total possible per week		\$23.10												
Total earned for week of February 8–14, 2009		\$15.40												

tests. Still, performance-based assessment is a necessary component of any assessment program because it is the only method of discerning hands-on abilities.

There is a direct relationship between the importance that you place on a performance and the complexity of your students' performances: The more important the performance, the greater the number of its components. Hence the importance of the performance determines the point value of the rubric. For example, major performances, such as the English–language arts example and the social studies example in the upcoming pages, require multiple-component rubrics, whereas less complex performances, such as the mathematics example on this page, require fewer dimensions. The following examples also demonstrate how to implement performance-based assessment within the major content areas.

EXAMPLES BY CONTENT AREA

Mathematics

To determine the extent to which your students can use manipulatives to solve problems, first clearly define what you expect of your students and then construct clearly defined analytic rubrics for assessing their performance.

Objective

With an assortment of blue (25¢), red (10¢), and white (5¢) game chips, students will use some combination using every color to total exactly one dollar. The amount of time it takes is a factor in scoring.

This would be a Synthesis-level task because the students will be assembling parts to make a whole. Table 6.4 shows an example of an applicable rubric.

This analytic rubric provides time standards and states that each of the colors must be used in arriving at the required totals. Remember, award points according to the importance of the performance.

Science

You could assess your students' creativity in constructing a functional device, which could be framed as either a restricted or an extended performance.

Table 6.4

<i>Criteria</i>	<i>Maximum Points</i>	<i>Points Earned</i>
Includes all colors within 5 minutes	3	
Includes all colors within 6 minutes	2	
Includes all colors within 7 minutes	1	
Totals \$1.00 using all colors	10	
Totals \$.95–\$1.05 using all colors	7	
Totals \$.85–\$1.10 using all colors	5	
Totals \$.75–\$1.15 using all colors	3	
Totals \$.74–\$1.20 using all colors	1	
Uses less than three colors	0	
	13 Possible Points	

Objective

Given a 12" piece of aluminum foil, 14 toothpicks, and 8 inches of Scotch tape, students will individually construct a boat that will keep 10 pennies afloat for 3 minutes in a container of water supplied by the teacher.

This is a Synthesis-level objective since it necessitates creativity. Table 6.5 shows one possible rubric for its scoring.

The rubrics for this restricted performance are specific in their provision for maximum point values in 13 possible areas. Since it is an individual rather than a group task, each student's performance can be assessed quite accurately. Moreover, these rubrics virtually exclude subjective judgment, which enhances the objectivity of the assessment, even though the activity involves divergent thinking.

Social Studies

Here we use a similar example to an earlier one in a new way. Suppose after several classroom and textbook discussions on the necessity of interdependent relationships among people, you want to give your students an opportunity to design an interdependent effort among diverse people for a common goal. Since you are asking your students to be creative, this is a Synthesis-level objective.

Table 6.5

<i>Criteria</i>	<i>Maximum Points</i>	<i>Points Earned</i>
Includes all of the aluminum foil	2	
Includes all of the Scotch tape	2	
Includes each of the toothpicks	7 (1/2 pt. per each)	
Boat floats for 3 minutes	10	
Boat floats for 160–179 seconds	9	
Boat floats for 140–159 seconds	8	
Boat floats for 120–139 seconds	7	
Boat floats for 100–119 seconds	6	
Boat floats for 80–99 seconds	5	
Boat floats for 60–79 seconds	4	
Boat floats for 40–59 seconds	3	
Boat floats for 20–39 seconds	2	
Boat floats for 10–19 seconds	1	
	21 Possible Points	

Objective

As an extended group performance, two- and three-member groups of students will create a hypothetical group of diverse people, with respect to age, gender and skills, to produce a unique and salable product. Then following rules of grammar, spelling, capitalization and punctuation, each student group will write a report of 3 or 4 typewritten pages describing the product and how the diverse members would work cooperatively in its construction and sale.

The point values of these task-specific rubrics should reflect the emphasis you place on the different components of the performance. Table 6.6 gives you one possible set of rubrics for this activity. Note that the scores are for the group effort; each member would receive that score toward a summative assessment.

The rubrics for this extended group performance are precise and detailed, thus providing for assessment of each of the components. Remember, however, that assigning individual pupil scores for a group

Table 6.6

<i>Criteria</i>	<i>Points</i>		<i>Points</i>		<i>Points</i>		<i>Points</i>		<i>Points</i>		<i>Points</i>
Description of Groups	5	All three components mentioned but with little detail	4	Two components mentioned but with little detail	3	One component mentioned but with little detail	2	Little mention and sparse details regarding the three components	1	Hardly any mention and virtually no details of any of the components	0
Description and Relevance of Product	5	Adequate description of a unique and relatively salable product	4	Sketchy description of an ordinary product with some sales appeal	3	Vague description of a barely believable product with questionable sales appeal	2	Confusing description of a nondescript product with little sales appeal	1	Poor description of an unbelievable product with no sales appeal	0
Description of Cooperation Among Group Members in the	5	Adequate description of the somewhat believable cooperative interaction, mentioning	4	General description of cooperative interaction, mentioning two aspects of diversity	3	Unclear description of little cooperation, mentioning two aspects of diversity	2	Vague description of very little cooperation, mentioning two aspects of diversity	1	Garbled description of individuals with no mention of cooperation or diversity	0

(Continued)

Table 6.6 (Continued)

<i>Criteria</i>	<i>Points</i>	<i>Points</i>	<i>Points</i>	<i>Points</i>	<i>Points</i>	<i>Points</i>	<i>Points</i>	<i>Points</i>
Construction of the Product	hypothetical group members, with specific mention of the three characteristics of diversity	all three characteristics of diversity						
Description of Cooperation Among Group Members in the Sale of the Product	Clear, detailed description of believable, cooperative action among the hypothetical group members, with specific mention of the three characteristics of diversity	5 Adequate description of the somewhat believable cooperative interaction, mentioning all three characteristics of diversity	4 General description of cooperative interaction, mentioning two aspects of diversity	3 Unclear description of little cooperation, mentioning two aspects of diversity	2 Vague description of very little cooperation, mentioning two aspects of diversity	1 Garbled description of individuals with no mention of cooperation or diversity	0	

Table 6.6 (Continued)

Criteria	Points	Points	Points	Points	Points	Points	Points	Points	Points	Points	Points	
Clarity and Continuity	Easily understood; flows with sequential, step-by-step logic	5	Understandable; flows with some sequence	4	Somewhat understandable; some continuity	3	Difficult to understand; little continuity	2	Disorganized; no continuity	1	Not understandable	0
Grammar, Spelling, Capitalization, and Punctuation	No more than 2 errors	5	3 to 5 errors	4	6 or 7 errors	3	8 or 9 errors	2	10 or 11 errors	1	More than 12 errors	0
	Maximum Points	30			Points Student Earned							

Table 6.7

<i>Criteria</i>	<i>Maximum Points</i>	<i>Points Earned</i>
1. Description of each character's believability (up to 3 points per character)	9	
2. Use of each vocabulary word (one point for each word)	8	
3. Originality	4	
4. Organization, continuity, and flow	4	
5. Inclusion of each character (one point for each character)	3	
6. Grammar, spelling, capitalization, and punctuation	3	
7. Staying within page boundaries	3	
8. Completing within the period	3	
	37	

project is, at best, questionable. Nevertheless, you seldom have choices other than assigning across-the-group scores for a single project.

English–Language Arts

Instead of asking your students to use their vocabulary words in individual sentences, you could instruct them to use the words in their creation of a short story. With its emphasis on creativity, this is a Synthesis-level objective.

Objective

As an in-class assignment, students will use each of their eight vocabulary words in a one- to one-and-a-half-page story with three characters describing how a dog and a cat cooperate to help a lost child.

Restricted and individual, this assignment is clear regarding what the students are to include in their short stories. Table 6.7 outlines a suggested analytical rubric.

The suggested rubric allows you to use your judgment for eight specific areas. Since it is an in-class assignment, it is not recommended that you exercise the same scrutiny as with an out-of-class assignment.

SUMMARY

Performance-based assessment is applied to skills and abilities that cannot be evaluated by traditional paper-and-pencil tests. This method of assessment can target process or product, and time-restricted or time-extended activities. Like other forms of assessment, this one has definite strengths as well as pronounced weaknesses.

For scoring, although generic rubric models are valuable, tailoring your rubrics to individual performances, as detailed in your daily instructional objectives, allows for more precise evaluation. In this type of assessment, as in others, clearly defined objectives make for easy construction of objective and detailed rubrics that minimize scoring subjectivity.

PROFESSIONAL DEVELOPMENT ACTIVITIES

In groups of three or four, select content areas and construct performance-based activities, either for individuals or for groups. Once you have determined these activities, begin constructing the rubric. If you have questions, refer to the chapter examples. Make sure you know the cognitive level of your activities. After completion, put every group's items on the board for discussion.

WWW RESOURCES

http://www.aurbach.com/alt_assess.html

This Web site defines various types of performance-based assessment, along with their respective components.

<http://www.miamisci.org/ph/lpdefine.html>

The University of Miami Web site offers real-world challenges for cooperative or individual completion of authentic project and tasks, along with suggestions for assessing student performances.

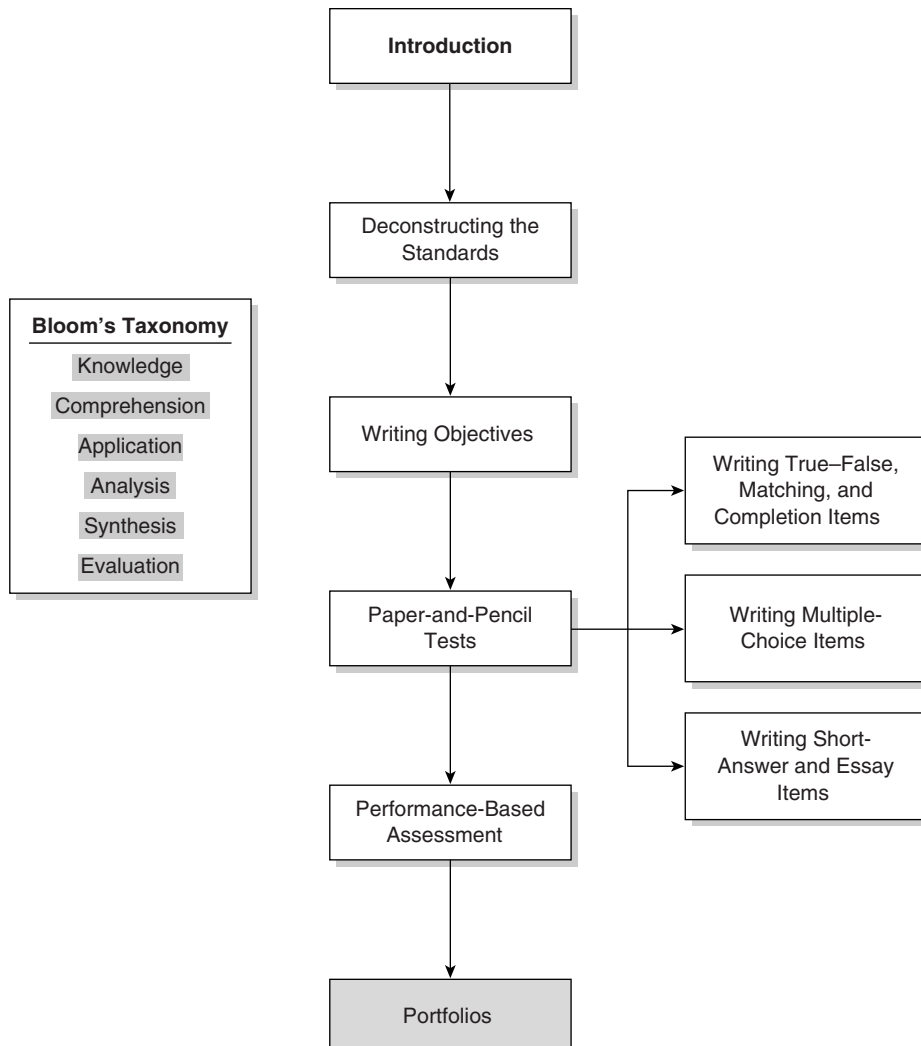
Many generic rubrics are available on the Web, as are sources of technology assessment, some of which are listed in Table 6.8.

Table 6.8 Web Sites That Contain Examples of Generic Rubrics

Assess and Report Progress	http://www.metiri.com/8steps/STEPeightRubrics.htm
Discovery Channel School	http://school.discovery.com/schrockguide/assess.html
teAchnology	http://www.teach-nology.com/web_tools/rubrics/
Education Service Center, Region 20	http://www.esc20.k12.tx.us/etprojects/rubrics/Default.htm
MyTeacherTools.com	http://www.rubrics4teachers.com/
Secondary School Educators	http://712educators.about.com/cs/rubrics/a/rubrics.htm
University of Wisconsin-Stout	http://www.uwstout.edu/soe/profdev/rubrics.shtml
The WebQuest Page	http://webquest.sdsu.edu/
PALS: Tasks	http://pals.sri.com/tasks/

7

Portfolios



The portfolio can be a highly effective device for exhibiting both the processes and the products of student efforts. Nevertheless, many educators insist that there are two distinct types of portfolios: those that evidence pupil progress (growth), and those that show the students' best efforts (showcase). In this chapter, we demonstrate that a single portfolio can simultaneously serve as both a growth chart and a showcase, without requiring a warehouse for its storage.

The contents of a portfolio should include representative samples of a student's performance within each of the levels of the cognitive hierarchy within a particular content area. It should display selected representative examples of pupil processes that led to demonstrated accomplishments within each of the levels of a cognitive hierarchy. To ensure that the display reflects curricular content as well as performances within each of the cognitive levels, you could also include unit and daily instructional objectives and test and performance-based assessment results.

Encourage your students to participate in the selection of their portfolio entries and stress the importance of representing their growth. Hence, the portfolio should show not only finished products but also the sequential steps leading to them. Note that presenting only a student's best or worst work provides a misrepresentation, which can be prevented through teacher guidance.

Once portfolios have been assembled, set aside time for your students to review them and then write and enter their reflections for later review. Although these reflections can be time consuming, they can provide valuable insight into your students' reactions to their academic involvements. Also, regularly set aside time for teacher–student conferences to discuss the progress that your students have achieved to date. Such pupil involvement is designed to allow the students to assess their own learning, and enable them to assume ownership of their learning as well. Moreover, whether the portfolios are housed in folders or electronically, the students should work with you in dating and categorizing the material according to topic, cognitive level, and process-to-product sequence, in compliance with national or state standards (Chapter 1). Furthermore, the students should construct tables of contents both for their own use and for teacher–student and parent–teacher conferences. Box 7.1 contains a vignette regarding a portfolio's development.

Box 7.1

In conference with Miranda, Mr. Zatopec has suggested including a corrected rough draft of her term paper in her portfolio. Miranda asserts that this version does not

represent her best work. Agreeing, her teacher reminds her that a portfolio should reflect process and growth. He explains that this rough draft will become more meaningful when compared with the final version, which could be included later. Miranda agrees.

When portfolios contain an overabundance of your students' work, they become less meaningful. By inserting carefully selected representative samples of the students' performances according to the cognitive hierarchy, you, your students, and their parents can better understand the students' areas of cognitive strengths and weaknesses. Box 7.2 contains a vignette showing the use of a portfolio in a parent conference.

Box 7.2

In a meeting with Ms. Fong, Jamal Washington's father says that he is puzzled because his son did not have an A on his interim report, especially after receiving near-perfect scores on all of his spelling, labeling, and definition exercises, as well as a high score on an in-class opinion paper. After the two of them review Jamal's portfolio, which is arranged by date and cognitive level, Mr. Washington understands that although Jamal is making progress, he still needs to work on his Comprehension-, Application-, and Synthesis-level skills.

Rather than using traditional portfolio containers, you may wish to enter your students' work samples electronically. (The WWW Resources section at the end of the chapter provides Web resources for electronic portfolios.) Electronic portfolios can include graphics as well as video and sound, and they are easily accessible. Moreover, meaningful connections among different subject matter areas can be made.

CONTENT AREAS, COGNITIVE LEVELS, AND PORTFOLIO ENTRIES

The following examples, some employed in Chapter 2, demonstrate how your unit and daily instructional objectives can serve as guidelines for the selection of appropriate and representative portfolio artifacts. For performance-based activities, you and your students can choose from among the scored rubrics of completed tasks (see Chapter 6). A sample objective is cited at each cognitive level with a corresponding artifact suggested for the portfolios.

Mathematics

Knowledge Level: Students can recognize and recall previously learned information; no comprehension or understanding of the information is implied.

You and your students will want to select from among activities within this level as a starting point for displaying their progression through the cognitive hierarchy of the curriculum. For instance, in accordance with your unit and daily instructional objectives you and your student could select a portfolio entry from among tasks that involved Knowledge-level performance with multiplication facts, perhaps one of the students' returned homework assignments. Alternatively, you could include the results of a classroom activity, such as the one dictated by the following daily instructional objective that was mentioned in Chapter 2.

Sample Lesson Objective: In class, students will write the multiples of 2 from zero to 10, with no more than two errors.

Perhaps a less successful attempt to meet the objective could be entered as a baseline for demonstrating growth, and then the most successful attempt could be included to display the student's final product.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

If you have given your students the opportunity to continue number patterns to understand data trends, those results could be considered for inclusion in a portfolio.

Sample Lesson Objective: When presented with a worksheet containing five different numerical patterns of four numbers each, the student will write the next two numbers for each pattern.

Depending on the student's performance on this daily instructional objective, you and your student may decide to use the scored worksheet as either a process-oriented or a product-oriented work sample.

Application Level: Students have the ability to take information that has previously been acquired and comprehended and use it in concrete situations.

When you determine that your students are at an adequate reading level and are comfortable in their computations of addition and subtraction, the logical step would be to engage them in solving word problems (the opportunity to use previously acquired and comprehended skills in concrete situations). The resulting worksheets could be considered by you and a particular student as a representative Application artifact for the student's portfolio.

Sample Lesson Objective: When presented with a work sheet containing five word problems involving the addition and subtraction of three-digit numbers, the students will solve at least three.

Since this could be one of the student's first encounters with word problems, the two of you may want to consider the reviewed worksheet as a baseline growth-oriented work sample.

Analysis Level: Students are able to break a unified whole into its basic parts and understand the relationship among those parts, compare and contrast phenomena, understand metaphors and analogies, understand the relationship between cause and effect, and categorize phenomena.

Knowing that breaking down a unified whole into its basic parts and demonstrating an understanding among those parts is an Analysis-level behavior, you could ask your students to demonstrate this behavior with manipulatives. Then, you and your student may examine the scored rubric of his performance and determine whether to enter it in the portfolio as a representative sample of performance at this cognitive level.

Sample Lesson Objective: When presented with stacks of Monopoly ones, fives, tens, and twenties, the student will demonstrate at least three ways to break a one hundred dollar bill into a combination of each of the four listed denominations.

You could possibly use a rubric that allows for the assessment of both accuracy and speed: correct combinations and total time for their assemblages. Then, after reviewing the scored rubric, the two of you could decide whether to include it as a portfolio artifact. If you agree to enter the rubric, you could enter it either as a representative process or as a product work sample, depending on the quality of the student's performance.

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Creative, content-related activities can increase students' expertise within content areas. The scored rubrics of these efforts are excellent possible portfolio entries.

Sample Lesson Objective: As an out-of-class activity, students will design three word problems, each involving the addition of two three-digit numbers.

This objective provides students with the opportunity for creative expression, and it also expands their mathematical performance. Examine the scored rubrics of their respective performances with all students individually for portfolio entry, either as a process-oriented or as a product-oriented item, depending on the quality of the performance.

Evaluation Level: Students are able to make value judgments on the basis of predetermined criteria or internal consistency. Since value judgments often involve personal choices, you should assess the students' rationale for their decisions as opposed to their decisions per se.

Asking your students to make value judgments about mathematical operations can give you insight into their perceived strengths and weaknesses. This in turn should help you assist them in capitalizing on their strengths and correcting their weaknesses. You and your students may wish to examine the accounts of these value judgments as possible portfolio artifacts.

Sample Lesson Objective: As a written classroom assignment, students will state whether they prefer the mathematical operations of multiplication of double digits, long division, or regrouping and list at least three reasons for their preference.

After examining the scored rubric of the performance, you and your student may wish to consider it for a portfolio work sample. Depending on the acknowledged weaknesses of the student and the success of the attempts to remove them, you and your student may consider entering the document either as a process- or as a product-level work sample.

Science

Knowledge Level: Students are expected to recognize and recall previously learned information; no comprehension or understanding of the information is implied.

You and your students can select from among activities within this level to establish starting points for displaying their progression through the cognitive hierarchy of the curriculum, as the following exercise demonstrated in Chapter 2:

Sample Lesson Objective: As a written exercise, the students will correctly list at least three characteristics of mammals.

This work sample could be included in the portfolio as an example of either process or product.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Written and scored summaries of field trip observations are good examples of work at this level.

Sample Lesson Objective: As a written assignment following a field trip to a museum, students will describe one observed prehistoric reptile, including at least three of its physical characteristics.

Inclusion of the student's scored description could be a representative portfolio work sample. If a particular paper is of a higher quality than a previous entry, it could be included as product entry, or it could serve as a process contribution.

Application Level: Students are able to take information that has previously been acquired and comprehended and use it in concrete situations.

Field trips being excellent sources for application of classroom-acquired concepts, evidence of students' involvement in field trips may be considered as Application-level entries for their portfolios.

Sample Lesson Objective: On a field trip, students will identify and collect leaves from five different types of trees, as specified on a list provided by the teacher.

A student's scored rubric of the assembled leaf display could be considered by the two of you as a representative product-oriented Application-level piece for the portfolio. The leaf display itself could also be considered for portfolio entry.

Analysis Level: Students are able to break down a unified whole into its basic parts and understand the relationship among these parts, determine cause-effect relationships, understand analogies and metaphors, and categorize phenomena.

Understanding cause-effect relationships is an Analysis-level performance. Including the record of a student's response to the following daily instructional objective could be a representative portfolio artifact.

Sample Lesson Objective: After observing the mixing of vinegar, mouthwash, instant iced tea, and baking soda in a beaker of water, students will list the two components involved in the reaction.

The scored lab sheet of this Analysis-level assignment could serve as a growth-oriented process portfolio entry, serving as a precursor of more complex laboratory observations.

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Manipulatives can be excellent sources for creative, hands-on involvement with previously developed concepts. If you have had your students create models to represent particular concepts, photographs of their models could be considered as possible portfolio artifacts.

Sample Lesson Objective: With a set of Lego blocks, in two-person groups, students will create a linear DNA model according to their personal creativity, with the requirement that the bases be correctly paired and color coded.

A photograph of such a project could be considered as a growth-oriented or product-oriented inclusion in the students' portfolios.

Evaluation Level: Students are able to judge a phenomenon on the basis of predetermined criteria or internal consistency.

Asking students for value judgments regarding theories draws upon their evaluation abilities and calls for you to assess the rationale for their decisions as opposed to their decisions *per se*. An assessed rationale could be included in a student's portfolio as an example of this level of cognition.

Sample Lesson Objective: After reading and discussing separate theories regarding the dinosaurs' extinction, students will individually determine which theory they think is the best and then write three reasons for their choice.

The mutual examination of a student's assessed paper can serve as a source of enlightenment for you both. Then you and your student could determine whether the assessed paper should become a part of the portfolio, and if so, whether as a process- or as a product-oriented inclusion.

Social Studies

Knowledge Level: Students are able to recognize and recall previously learned information; no comprehension or understanding of the information is implied.

You and your students will want to select from among activities within this level to establish a starting point for displaying their progression through the cognitive hierarchy of the curriculum.

For a representative entry into the student's portfolio, the two of you may decide to include the results pertaining to a daily instructional objective, such as the following:

Sample Lesson Objective: As a written assignment, students will list the three branches of government, spelling errors excluded.

A student's daily quiz papers could be entered as a growth example if the standards of the objective were not met and as a product entry if they were.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Understanding population trends is a Comprehension-level performance, per the following daily objective.

Sample Lesson Objective: When presented with a bar graph showing the increasing population trends of the school over the past five years,

students will continue the graph by drawing a bar to represent the next year's probable population.

The returned graph, with your comments and suggestions, would be excellent as a baseline process work sample for showing increasingly complex performances with demographic data, which later papers would demonstrate.

Application Level: Students are able to take information that has previously been acquired and comprehended and use it in concrete situations.

Calculating distances between given locations is a component of many geographical exercises. Evidence of this ability could be considered by student and teacher as an appropriate portfolio entry.

Sample Lesson Objective: When presented with a state map, students will calculate and list the distance between two given points within a five-mile margin of error.

You and your student could use the written assessment of the student's performance as a representative portfolio inclusion. The two of you could categorize it either as part of a process or as a product.

Analysis Level: Students are able to break down a unified whole into its basic parts and understand the relationship among these parts, determine cause-effect relationships, understand analogies and metaphors, and classify phenomena.

If you ask your students to determine causal relationships between previous events and current conditions, you and your students could consider the scored analyses for entry in their portfolios.

Sample Lesson Objective: As individual assignments, students will list three ways that the Internet has changed life in the United States.

Although this is not a lengthy assignment, it requires students to determine three current conditions following a specific cause. The scored results of a student's paper could be a process-oriented representative sample.

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Opportunities for creative expression, such as the sample objective shown, can add reality to students' perceptions of history. The scored rubrics of their efforts could be good artifacts for this level of cognition.

Sample Lesson Objective: As an out-of-class assignment, students will imagine themselves as members of either the Union or the Confederate Army and write a one- to two-page letter from Gettysburg describing their feelings about tomorrow's battle.

After receiving the scored rubric of this creative endeavor, the student may ask you to assist in determining whether it should be included in the portfolio as either a process-oriented or a product-oriented work sample, depending on its quality and when it occurred in the semester.

Evaluation Level: Students are able to judge a phenomenon on the basis of predetermined criteria or internal consistency.

If you have your students evaluate the states that they have studied on the basis of the states' perceived merits, you could mutually decide whether the students' assessed evaluations should be included in their portfolios. (When assessing their evaluations, keep in mind that we have different value hierarchies and priorities.)

Sample Lesson Objective: During a geography unit, students will select one state in which they would prefer to live and write three reasons for their choice, one regarding each of the following: climate, recreational opportunities and job opportunities.

After you have assessed the student's reasoning, the two of you can decide whether to enter the assessed paper as a portfolio work sample, and if so, whether as a process- or a product-oriented inclusion.

English–Language Arts

Knowledge Level: Students recognize and recall previously learned information; no comprehension or understanding of the information is implied.

Activities within this level establish a starting point for displaying students' progression through the cognitive hierarchy of the curriculum. A good choice might be a student's vocabulary quizzes.

Sample Lesson Objective: On a twenty-item written vocabulary exercise, students will write at least eighteen of the definitions correctly.

Depending on how well the student met the standards of the objective, the two of you could decide whether to enter it either as a representative growth or product sample.

Comprehension Level: Students are able to understand or summarize information, translate information from one form or level to another, and comprehend data trends.

Understanding the use of words as different parts of speech is a Comprehension-level performance, and a document to demonstrate this understanding could be a representative portfolio entry.

Sample Lesson Objective: When presented with a ten-item list of adjectives and adverbs, the students will circle the adjectives and underline the adverbs with no more than two errors.

You and your student could decide to use the scored result of this activity as a Comprehension-level artifact for the portfolio. Since the

assignment involves basic understanding that is prerequisite to higher-level performances, the two of you could insert it as a process-level work sample.

Application Level: Students are able to take information that has previously been acquired and comprehended and use it in concrete situations.

Daily exercises can be representative samples of student growth. For example, by using assigned vocabulary words in written sentences, the student has demonstrated Knowledge, Comprehension, and Application of these words. Hence, the two of you may consider inserting some of the corrected exercises as growth-oriented artifacts.

Sample Lesson Objective: As a written assignment, the students will correctly use at least eight of ten vocabulary words in separate sentences.

This is an Application-level objective because the student must take definitions that have been acquired and comprehended and use them in sentences. Since vocabulary use is an important component of any content area, you and your student may want to consider the corrected paper for a representative process entry in the portfolio.

Analysis Level: Students are able to break down a unified whole into its basic parts and understand the relationship among these parts, determine cause–effect relationships, and understand analogies and metaphors.

If you have asked your students to analyze a business letter, for instance, then you and each of your students could decide whether to enter the letter with its graded results as a representative portfolio inclusion.

Sample Lesson Objective: Given a business letter, students will label the heading, greeting, body and complimentary close.

Your student and you could consider including the scored paper as either a process or a product entry.

Synthesis Level: Students are able to assemble parts into a whole, formulate new hypotheses or plans of action, and construct solutions to unfamiliar problems.

Creative writing is a prime example of Synthesis-level thinking. The results of an objective like the following could be included to demonstrate it.

Sample Lesson Objective: As a two- to two-and-a-half-page out-of-class assignment, students will write a short story that contains a setting, two major characters, a minor character, an action event, and a surprise ending.

After this paper has been scored in compliance with your rubric, you and your student can examine it as a possible portfolio artifact displaying the student's creative writing skills. You could enter it either as a process-oriented or as a product-oriented inclusion, depending on its place in the sequence of assignments and its quality.

Evaluation Level: Students are able to judge a phenomenon on the basis of predetermined criteria or internal consistency.

Since you probably give your students the opportunity to evaluate some of their reading assignments, you and your individual students may consider their assessed evaluations as possible portfolio entries.

Sample Lesson Objective: After reflecting on their readings of *The Lion, the Witch, and the Wardrobe* and *Harry Potter and the Sorcerer's Stone*, students will explain, within two pages, which book's treatment of fantasy they prefer, including three reasons for their choice within their narratives.

Because this is an Evaluation-level assignment with its requirement for a value judgment, you and your student can consider the scored rubric of the student's paper as a possible portfolio inclusion. Once again, it could be entered either as a process- or as a product-oriented addition, depending on the quality and place within the sequence of the term.

SUMMARY

Portfolio artifacts should be representative samples of both the curriculum and the student's work, because the inclusion of unrepresentative curriculum samples or atypically best examples of work only serve to distort and mislead. You and each of your students should select representative samples from each of the six levels of the cognitive hierarchy for inclusion in each portfolio to give you, your student, and the parents a broader and more accurate picture of the student's relative strengths and weaknesses. For example, you may learn that a student is having difficulty applying some of the concepts that were memorized because they were not comprehended.

Since learning should be a continual process, your students' portfolios should reflect growth. To show this process, the portfolio should contain work samples that show processes as well as products. If your students take part in the selection of their portfolio inclusions, they can see the progress of their learning, and they can assume ownership of it as well.

PROFESSIONAL DEVELOPMENT ACTIVITIES

In pairs according to subject area, review the definitions of the hierarchical levels. Now each of you write a couple of objectives for specific tasks, either paper-and-pencil or performance, for the different levels of the hierarchy.

From these, together create a scenario of a student's degree of fulfillment of each of these objectives.

Now you are ready to role-play before the group. Alternate the roles of the teacher and student in a discussion of whether each record of the student's performance should be entered into the portfolio, and if so, whether it should be a process or a product work sample. Following each of the role-playing sessions, invite comments from the group.

WWW RESOURCES

<http://www.miamisci.org/ph/lpdefine.html>

This University of Miami Web site offers suggestions pertaining to the maintenance of portfolios that reflect student processes and products.

<http://ncrel.org/sdrs/areas/issues/students/learning/lr2port.htm>

This Web site of the North Central Regional Educational Lab offers suggestions regarding instruction to students pertaining to the content and placement of their portfolio entries.

Table 7.1 shows a few Web sites with information on portfolios and electronic portfolios.

Table 7.1 Portfolio and Electronic Portfolio Web Sites

Elementary Teaching Portfolio	http://primaryschool.suite101.com/article.cfm/elementary_teaching_portfolio
Discovery Channel School	http://school.discovery.com/schrockguide/assess.html
Technology Applications Center for Educator Development	http://www.tcet.unt.edu/START/assess/elecport.htm

Conclusion

In the course of this book, we have shown you how to deconstruct the standards of the major content areas by first modifying them and then converting them into unit and measurable daily instructional objectives with increasing specificity. You have seen how to write unit plan objectives and then break them into measurable daily instructional objectives using Bloom et al.'s (1956) cognitive hierarchy in each of the major content areas. In addition, you can now write a variety of test items that progressively ascend through the cognitive levels, and you are able to construct appropriate rubrics for the assessment of your students' written and performance-based activities. Then, as a visible record of each of your students' performances at the different levels of the hierarchy, you can together categorize their respective artifacts into hierarchically organized portfolios.

The instructional and assessment hierarchy that is the heart of this book is a powerful vehicle, not simply another educational model for enhancing academic proficiency. It can provide your students with highly valued 21st-century skills, regardless of which vocational paths they may later select (e.g., Gewertz, 2008). These skills, identified by respected representatives of the business, education, and policymaking communities, are measurable higher-order thinking skills sought after in virtually every field of employment (for more information on these skills, see www.21stcenturyskills.org). Hence, because of your students' progression through the cognitive domains, they will someday be able to make easy and successful transitions into their respective workplaces, where they can implement the higher-order thought processes that they acquired via your direction.

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