01-Marzano-45105.qxd 11/23/2006 12:17 PM Page 1

Chapter One

The Need for a Revision of Bloom's Taxonomy

In 1956, a small, somewhat technical volume was published under the title, *Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain* (Bloom et al., 1956). In the 50-plus years since its publication, "Bloom's Taxonomy," as it is frequently referred to in deference to Benjamin Bloom, the work's editor, has been used by educators in virtually every subject area at virtually every grade level. The expressed purpose of the taxonomy was to develop a codification system whereby educators could design learning objectives that have a hierarchical organization.

> You are reading about an attempt to build a taxonomy of educational objectives. It is intended to provide for classification of the goals of our educational system. It is expected to be of general help to all teachers, administrators, professional specialists, and research workers who deal with curricular and evaluation problems. (p. 1)

That Bloom's Taxonomy is still used after some 50 years is a testament to its contribution to education and psychology. Indeed, the 93rd yearbook of the National Society for the Study of Education (NSSE), titled *Bloom's Taxonomy: A Forty-Year Retrospective,* documents the impact of the work:

> Arguably, one of the most influential educational monographs of the past half century is the *Taxonomy of Educational Objectives, The Classification of Educational Goals, Handbook I: Cognitive Domain.* Nearly forty years after its publication in 1956 the volume remains a standard reference for discussions of testing and evaluation, curriculum development, and teaching and teacher education. A search of the most recent *Social*

> *Science Citation Index* (1992) revealed more than 150 citations to the *Handbook.* At a recent meeting of approximately 200 administrators and teachers, the senior editor of this volume asked for a show of hands in response to the question, "How many of you have heard of Bloom's Taxonomy?" Virtually every hand in the audience was raised. Few education publications have enjoyed such overwhelming recognition for so long. (Anderson & Sosniak, 1994, p. vii)

Those interested in a thorough discussion of the many uses and analyses of Bloom's Taxonomy should consult the 1994 NSSE yearbook. However, a brief synopsis is useful here.

A Brief History of the Use of Bloom's Taxonomy

A scrutiny of the past 50-plus years in education indicates that Bloom's Taxonomy has had a significant, albeit uneven, influence on educational theory and practice. According to Peter Airasian (1994), the taxonomy fitted nicely into the instructional objectives movement that attained national prominence after the publication of Robert Mager's (1962) *Preparing Instructional Objectives*. Mager's book was explicitly designed to help those intending to develop a methodology of programmed instruction and was based on the premise that cognitive tasks could be ordered hierarchically. Airasian (1994) notes that "one might think, given this affinity, that the taxonomy would have been an influential tool in the development of programmed instructional sequences. In one sense it was" (p. 87). As Edgar Dale (1967) explains, Bloom's Taxonomy became the structure around which many initial efforts at programmed instruction were organized. However, Airasian (1994) argues that Bloom's Taxonomy was ultimately replaced by Gagne's (1977) framework as the conceptual organizer for programmed instruction. Although Gagne's framework was less hierarchical than Bloom's Taxonomy, it was more easily translated into instructional practice.

Whereas Bloom's Taxonomy had a minimal influence on curriculum, it had a strong effect on evaluation. By 1970, Ralph Tyler's model of evaluation design was fairly well established. Specifically, Tyler presented an objectives-based view of evaluation in which a program or an instructional intervention was evaluated on the extent to which it had accomplished its explicit goals (for a discussion of Tyler's model, see Madaus & Stufflebeam, 1989). The more precisely goals were stated, the more precisely a program could be evaluated. Bloom's Taxonomy proved to be a powerful tool for objectives-based evaluation in that it allowed for a level of detail in stating goals that had not previously been readily attained.

Bloom's Taxonomy also proved to be a valuable tool for those who ascribed to the model of evaluation known as the "planning, programming, budgeting system" (PPBS). Initially used in the Pentagon, PPBS followed Tyler's tenets of objectives-based evaluation in that it was predicated on first identifying the intended outcomes of a program, then measuring the extent to which these outcomes had been achieved at the program's conclusion. This system became popular in education when it was adopted as the primary tool for evaluating the effectiveness of the 1965 Elementary and Secondary Education Act (ESEA), which was a direct consequence of President Lyndon Johnson's War on Poverty. Under ESEA, Title I funds were allocated to provide additional educational services to lower-achieving students in schools having large proportions of children from low-income backgrounds. Airasian (1994) explains that "for the first time in history substantial amounts of federal aid, more than a billion dollars a year at its inception, were funneled into local school districts to meet the educational needs of disadvantaged children" (p. 89). Given the scale of the financial aid available to schools under Title I, some politicians demanded reporting requirements that would ensure the monies were being used appropriately. Eventually, PPBS became the preferred Title I assessment vehicle and Bloom's Taxonomy the preferred system for articulating program objectives.

The 1970s also marked the beginning of statewide testing. Indeed, in 1960 only one state had a mandated statewide test; by 1985, 32 states had mandated tests. Virtually every state test was designed to provide information about student achievement on specific topics within specific subject areas, and virtually every state test made use of Bloom's Taxonomy, at least to some extent, to define various levels of skill. By the mid-1970s, state tests began to take a minimum-competency approach. As Airasian (1987) explained, minimum-competency tests were different from the more general forms of tests in at least three ways: (1) They were mandated for all schools and virtually all students within a state in which their predecessors could be administered to representative samples of students; (2) the mandate took away much, if not all, of individual districts' discretion in terms of test selection, administration, scoring, and interpretation; and (3) the tests had built-in sanctions if specific levels of performance were not met. Again, Bloom's Taxonomy was widely used as the model for designing items that measure low-level or basic skills versus so-called higher-level skills.

The 1980s saw the beginning of an emphasis on teaching higher levels of thinking. It was this movement, along with research on the validity of Bloom's Taxonomy (reviewed in a subsequent section), that raised awareness as to the need to revise it. A barrage of books, articles, and reports appeared, supporting the need for instruction in thinking and reasoning skills. For example, such prominent organizations as the Education Commission of the States (1982) and the College Entrance Examination Board (1983) highlighted the need to teach thinking. High-impact reports, such as *A Nation at Risk* (National Commission, 1983), pointed to deficiencies in higher-level thinking as a major weakness in American education. Widely read journals, such as *Educational Leadership* and *Review of Educational Research,* devoted entire volumes to the topic (e.g., see Brandt, 1986, and Glasman & Pellegrino, 1984, respectively). Many of these publications cited evidence of students' inability to answer higher-level questions and apply their knowledge.

In May 1984, the Association for Supervision and Curriculum Development (ASCD) called a meeting at the Wingspread Conference Center in Racine, Wisconsin, to consider possible solutions to the problem of students' poor performance on tasks that demand higher-level thinking. One of the suggestions from the conference was that Bloom's Taxonomy should be updated to include current research and theory on the nature of knowledge and the nature of cognition (for a discussion of that conference, see Marzano, Brandt, et al., 1988). As a direct result of that conference, the Association Collaborative for Teaching Thinking was formed. Twenty-eight organizations were official participants in the collaborative, including

American Association of School Administrators

American Association of School Librarians

American Educational Research Association

American Federation of Teachers

Association for Supervision and Curriculum Development

Council of Chief State School Officers

Home Economics Education Association

International Reading Association

Music Educators National Conference

National Alliance of Black School Educators

National Art Education Association

National Association of Elementary School Principals

National Association of Secondary School Principals

National Council for the Social Studies

National Council of Teachers of English

National Council of Teachers of Mathematics

National Education Association

National Middle School Association

National School Boards Association

National Science Teachers Association

Unfortunately, the collaborative never produced a revision of Bloom's Taxonomy.

Bloom's Taxonomy: A Summary

Given that this work is designed to update Bloom's Taxonomy, it is useful to briefly review it. In its most general form, Bloom's Taxonomy outlines six levels of cognitive processes:

1.00 Knowledge

2.00 Comprehension

3.00 Application

4.00 Analysis

5.00 Synthesis

6.00 Evaluation

Each level is designed to possess defining characteristics.

1.00 Knowledge

The *knowledge* level is operationally defined as information retrieval: "Knowledge as defined here includes those behaviors and test situations which emphasize the remembering, either by recognition or recall, of ideas, materials or phenomena" (Bloom et al., 1956, p. 62). A close examination of this first category shows that Bloom articulates specific types of knowledge, which include the following categories and subcategories:

1.10 Specifics
- 1.11 Terminology
- 1.12 Facts

1.20 Ways and means of dealing with specifics
- 1.21 Conventions
- 1.22 Trends and sequences
- 1.23 Classification and categories
- 1.24 Criteria
- 1.25 Methodology

1.30 Universals and abstractions
  1.31 Principles and generalizations
  1.32 Theories and structures

Bloom's category of knowledge, then, mixes the cognitive process of retrieval with the various types of knowledge that are retrieved.

2.00 Comprehension

Comprehension represents the largest class of intellectual skills and abilities. The central feature of the act of comprehension is taking in new information via some form of communication ("when students are confronted with a communication, they are expected to know what is being communicated and to be able to make some use of the materials or ideas contained in it" [p. 89]). The taxonomy does not limit communication to the presentation of information in linguistic (verbal or written) form. Rather, information can be presented symbolically or experientially. Thus a student attempting to understand the ideas underlying a demonstration would be involved in the act of comprehension.

Three forms of comprehension are described in the taxonomy: translation, interpretation, and extrapolation. *Translation* involves encoding incoming information into some form other than that in which it was received. For example, students would be engaged in translation if they summarized in their own words the information contained in a film on the formation of a tornado. Whereas translation involves the identification of the literal structure underlying the incoming information, *interpretation* "may require a reordering of ideas into a new configuration in the mind" (p. 90). Finally, *extrapolation* goes beyond the literal level of comprehension. It involves inferences and predictions based on literal information in the communication and principles and generalizations already possessed by the learner (p. 90).

3.00 Application

The third category of cognitive skills, *application,* is probably the least-well-defined in Bloom's Taxonomy. It is described in relationship to a specific type of knowledge—abstractions—and is defined primarily in terms of how it compares with other levels of the taxonomy. To illustrate, Bloom notes that the comprehension of an abstraction requires students to know the abstraction well enough that they can

> correctly demonstrate its use when specifically asked to do so. "Application," however, requires a step beyond this. Given a problem new to the student, he will apply the appropriate abstraction without having to be prompted as to which abstraction is correct or without having to be shown how to use it in that situation. (p. 120)

Bloom further explains that an abstraction understood at the level of comprehension can be used only when the conditions for its use are specified. However, the application of an abstraction is demonstrated when one correctly uses the abstraction in a situation in which no mode of solution is specified.

4.00 Analysis

Just as *application* is defined in terms of a subordinate category of Bloom's Taxonomy, *analysis* is defined in terms of application and comprehension. Bloom notes that,

> In *comprehension,* the emphasis is on the grasp of the meaning and intent of the material. In *application* it is on remembering and bringing to bear upon given material the appropriate generalizations or principles. *Analysis* emphasizes the detection of relationships of the parts and of the way they are organized. (p. 144)

Analysis is divided into three subcategories: the identification or classification of (1) elements, (2) relationships among elements, and (3) organizational principles that govern elements (p. 145).

Admittedly, this category overlaps with the categories of comprehension and evaluation: "No entirely clear lines can be drawn between analysis and comprehension at one end or between analysis and evaluation at the other" (p. 144).

5.00 Synthesis

Synthesis primarily involves the generation of new knowledge structures.

> Synthesis is defined here as putting together elements and parts as to form a whole. This is a process of working with elements, parts, etc., and combining them in such a way as to constitute a pattern or structure not clearly there before. Generally, this would involve a recombination of parts of previous experiences with new material, reconstructed into a new and more or less well-integrated whole. (p. 162)

Bloom explains that this category of cognition most clearly calls for creative behavior on the part of the student because it involves newly constructed and oftentimes unique products. Three specific categories of products are defined: (1) unique communications, (2) a plan or set of operations, and (3) a set of abstract relationships.

Again, Bloom acknowledges many similarities between this category and the previous categories: "Comprehension, application, and analysis also involve the putting together of elements and the construction of meanings, but these tend to be more partial and less compatible than synthesis in the magnitude of the task" (p. 162).

6.00 Evaluation

Evaluation involves making judgments about the value of knowledge. According to Bloom, it involves

> the use of criteria as well as standards for appraising the extent to which particulars are accurate, effective, economical, or satisfying. The judgments may be either quantitative or qualitative and the criteria may be either those determined by the student or those which are given to him. (p. 185)

Two forms of criteria or evidence are noted within this category: internal and external. By definition, *evaluation* is a form of decision making, done at a very conscious and thoughtful level, as opposed to decisions that are made quickly without much conscious thought. Bloom refers to the latter as "opinions," as opposed to "judgments," which, by definition, involve evaluation.

PROBLEMS WITH BLOOM'S TAXONOMY

As influential as Bloom's Taxonomy has been on educational practice, it has experienced some severe criticisms (for a review, see Kreitzer & Madaus, 1994). One of the most common criticisms was that the taxonomy oversimplified the nature of thought and its relationship to learning (Furst, 1994). The taxonomy certainly expanded the conception of learning from a simple, unidimensional, behaviorist model to one that was multidimensional and more constructivist in nature. However, it assumed a rather simple construct of difficulty as the characteristic separating one level from another: Superordinate levels involved more difficult cognitive processes than did subordinate levels. The research conducted on Bloom's Taxonomy simply did not support this structure. For example, educators who were trained in the structure of Bloom's Taxonomy were consistently unable to recognize questions at higher levels as more difficult than questions at lower levels of the taxonomy (see Fairbrother, 1975; Poole, 1972; Stanley & Bolton, 1957).

The problems with Bloom's Taxonomy were indirectly acknowledged by its authors. This is evidenced in their discussion of analysis: "It is probably more defensible educationally to consider analysis as an aid to fuller comprehension (a lower class level) or as a prelude to an evaluation of the material" (p. 144). The authors also acknowledged problems with the taxonomy's structure in their discussion of evaluation:

> Although evaluation is placed last in the cognitive domain because it is regarded as requiring to some extent all the other categories of behavior, it is not necessarily the last step in thinking or problem solving. It is quite possible that the evaluation process will in some cases be the prelude to the acquisition of new knowledge, a new attempt at comprehension or application, or a new analysis and synthesis. (p. 185)

In summary, the hierarchical structure of Bloom's Taxonomy simply did not hold together well from logical or empirical perspectives. As Rohwer and Sloane (1994) note, "The structure claimed for the hierarchy, then, *resembles* a hierarchy" (p. 47).

OTHER TAXONOMIES

Since the publication of Bloom's Taxonomy, others have attempted to update and improve on that initial effort. Many of these revisions have been reviewed by Moseley (n.d.) and by de Kock, Sleegers, and Voeten (2004). Depending on what one counts as an update or revision, over 20 can be identified. Of these, the effort most closely associated with Bloom's original work is that undertaken by Anderson et al. (2001). The ties to Bloom's work are many. Indeed, the title of Anderson et al.'s effort makes an explicit connection—*A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*—not to mention the fact that one of the authors—David Krathwohl—was a coauthor of Bloom's original taxonomy. According to Anderson et al., the revision was needed to update the framework in terms of the advances in cognitive psychology since its imprint and to use more "common language" (p. xxii) while articulating more "realistic examples" (p. xxii).

Anderson et al.'s (2001) taxonomy involves two basic dimensions. The first is referred to as the knowledge domain and involves four types of knowledge: factual, conceptual, procedural, and metacognitive. *Factual knowledge* involves "basic elements students must know to be acquainted with a discipline or solve a problem in it" (p. 29). *Conceptual knowledge* involves "the interrelationships among the basic elements within a larger structure that enable them to function together" (p. 29). *Procedural knowledge* involves "how to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods" (p. 29). *Metacognitive* knowledge involves "knowledge of cognition in general as well as awareness and knowledge of one's own cognition" (p. 29).

The second dimension is referred to as the cognitive process domain and involves six types of thinking. *Remembering* involves retrieving "relevant knowledge from long-term memory" (Anderson et al., 2001, p. 31). *Understanding* involves constructing "meaning from instructional messages, including oral, written, and graphic communication." *Applying* involves carrying out or using "a procedure in a given situation." *Analyzing* involves breaking material into constituent parts and determining "how parts relate to one another and to an overall structure or purpose." *Evaluating* involves making "judgments based on criteria and standards." *Creating* involves putting "elements together to form a coherent or functional whole" and reorganizing "elements into a new pattern or structure" (p. 31).

With the elements of both dimensions defined, educational objectives could be classified. To illustrate, Anderson et al. (2001) provide the example of an objective a teacher might establish in a science class: "The student will learn to apply the reduce-reuse-recycle approach to conservation" (p. 32). Since it involves knowledge about "doing something," this objective is classified as procedural along the knowledge dimension. Since the objective involves "carrying out" something, it is classified as application along the cognitive process dimension.

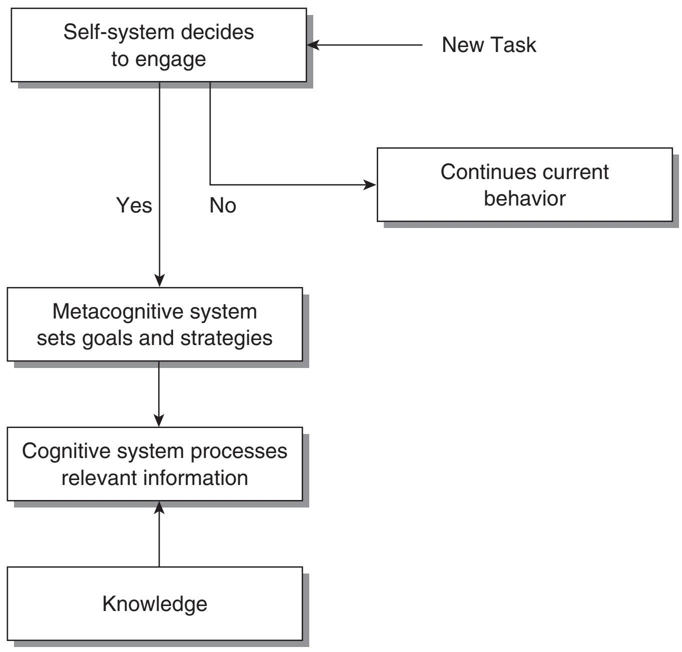
Certainly, the Anderson et al. (2001) effort added significantly to Bloom's original work. In addition, as the ensuing chapter will demonstrate, it has a great deal of similarity with the model we present in this book. However, as the discussion will demonstrate, the New Taxonomy presented here does not suffer from the same pitfalls as Bloom's Taxonomy and its progeny and is arguably friendlier to teachers in terms of its translation to classroom practice.

THE THEORETICAL BASIS FOR A NEW TAXONOMY

As mentioned, one of the problems in the approach taken by Bloom and his colleagues (and that of virtually every other revision or adaptation of Bloom's work) is that it attempted to use degrees of difficulty as the basis of the differences between levels of the taxonomy. Evaluation activities were assumed to be more difficult than activities that involved syntheses, which were assumed to be more difficult than activities involving analysis, and so on. Ultimately, any attempt to design a taxonomy based on difficulty of mental processing is doomed to failure, because of the well-established principle in psychology that even the most complex of processes can be learned at the level at which it is performed with little or no conscious effort (for discussions, see Anderson, 1983, 1990b, 1995; LaBerge, 1995; LaBerge & Samuels, 1974). The difficulty of a mental process is a function of at least two factors—the inherent complexity of the process in terms of steps involved and the level of familiarity one has with the process. The complexity of a mental process is invariant—the number of steps and their relationship do not change. However, familiarity with a process will change over time. The more familiar one is with a process, the more quickly one executes it, and the easier it becomes. To use an obvious example, the process of driving an automobile in rush-hour freeway traffic is very complex in terms of the number of interacting and complementary processes that are involved, each with a vast array of component parts. Yet most seasoned drivers would not consider the task difficult and frequently execute it while engaged in other unrelated tasks, such as talking on a cell phone, listening to the radio, and so on.

Although mental processes cannot be ordered hierarchically in terms of difficulty, they can be ordered in terms of control: Some processes exercise control over the operation of other processes. The model used to develop the New Taxonomy as described in this book is presented in Figure 1.1.

Figure 1.1 Model of Behavior



The model depicted in Figure 1.1 not only describes how human beings decide whether to engage in a new task at some point in time, but it also explains how information is processed once a decision to engage has been made. The model presents three mental systems: the self-system, the metacognitive system, and the cognitive system. The fourth component of the model is knowledge.

In this model, a *new task* is defined as an opportunity to change whatever one is doing or attending to at a particular time. For example, assume that a student is in a science class, daydreaming about an upcoming social activity after school, and energy and attention are focused on the social activity. However, if the teacher asked the student to pay attention to some new information that was being presented about science, he or she would be confronted with a decision regarding a new task. The decision made and the subsequent actions would be determined by the interaction of the student's self-, the metacognitive and cognitive systems, as well as his or her knowledge. Specifically, the self-system is engaged first, then the metacognitive system, and finally the cognitive system. All three systems use the student's store of knowledge.

THE THREE SYSTEMS AND KNOWLEDGE

The self-system contains a network of interrelated beliefs and goals (Csikszentmihalyi, 1990; Harter, 1980; Markus & Ruvulo, 1990) that are used to make judgments about the advisability of engaging in a new task. The self-system is also a prime determiner in the motivation one brings to a task (Garcia & Pintrich, 1991, 1993, 1995; Pintrich & Garcia, 1992). If a task is judged important, if the probability of success is high, and positive affect is generated or associated with the task, the individual will be motivated to engage in the new task (Ajzen, 1985; Ajzen & Fishbein, 1977, 1980; Ajzen & Madden, 1986). If the new task is evaluated as having low relevance or low probability of success and has an associated negative affect, motivation to engage in the task is low. To be highly motivated to attend to the new science information, then, the student would have to perceive the information as more important than the social event, believe the information can be comprehended, and have no strong negative emotions associated with it.

If a new task is selected, the metacognitive system is engaged. One of the initial jobs of the metacognitive system is to set goals relative to the new task (Schank & Abelson, 1977). This system is also responsible for designing strategies for accomplishing a given goal once it has been set (Sternberg, 1977, 1984a, 1984b, 1986a, 1986b). In terms of the student in the science class, the metacognitive system would be responsible for setting learning goals relative to the new information and designing strategies to accomplish those goals. The metacognitive system, once engaged, is continually interacting with the cognitive system.

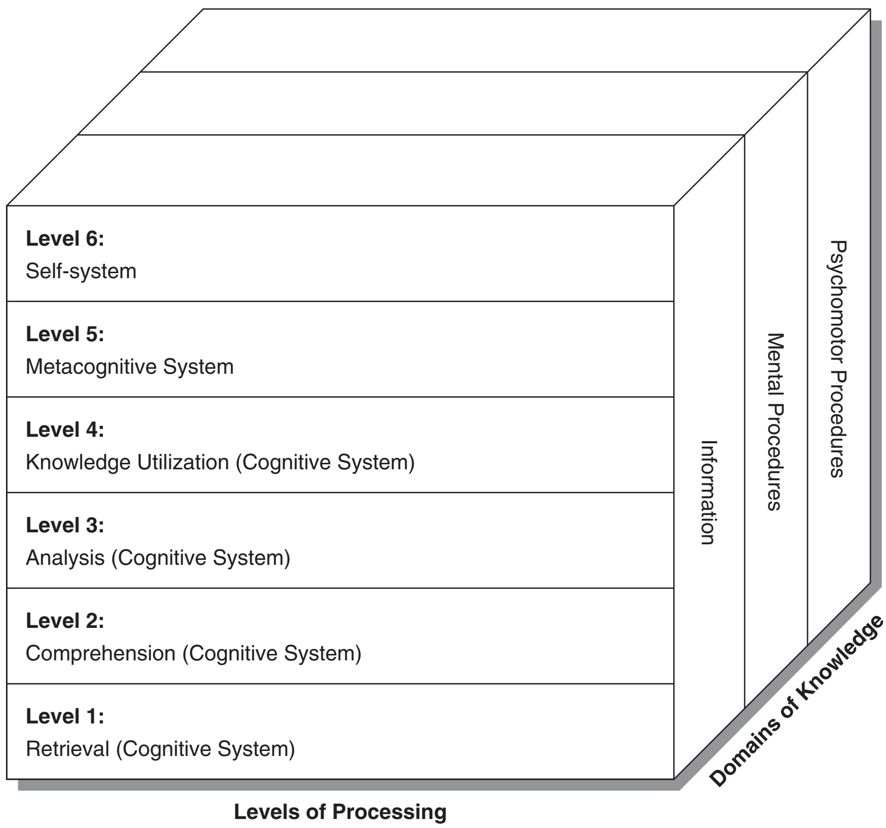
The cognitive system is responsible for the effective processing of the information that is essential to the completion of a task. It is responsible for analytic operations, such as making inference, comparing, classifying, and the like. For example, as our example student listens to the new information, he or she would undoubtedly have to make inferences about it, compare it with what he or she already knows, and so on.

Finally, relative to any new task, success is highly dependent on the amount of knowledge an individual has about that task (Anderson, 1995; Lindsay & Norman, 1977). For example, the extent to which the science student achieves the learning goals would to a great extent depend on prior knowledge about the science topic.

The New Taxonomy in Brief

The foregoing description underpins the design of the New Taxonomy as depicted in Figure 1.2.

Figure 1.2 The New Taxonomy



Here is a brief introduction to the New Taxonomy. The rows on the left-hand side of Figure 1.2 depict the three systems of thought and, in the case of the cognitive system, four subcomponents of that system. The columns depicted on the right-hand side depict three different types or domains of knowledge: information, mental procedures, and psychomotor procedures. The example involving the science student addressed the domain of information, specifically information about science. Had the teacher been a writing teacher wishing to engage the student in practice regarding a specific editing technique, let's say, the example would have addressed the domain of mental procedures. Had the teacher been a physical education teacher wishing to engage the student in a stretching activity, the example would have addressed the domain of psychomotor procedures.

In effect, the New Taxonomy is a two-dimensional model with six categories of mental processes represented by one dimension and three domains of knowledge represented by the other dimension. Educational objectives can be easily classified within these two dimensions. To illustrate, reconsider the objective used by Anderson et al. (2001) to exemplify how their taxonomy can be used to classify educational objectives: "The student will learn to apply the reduce-reuse-recycle approach to conservation" (p. 32). Within the New Taxonomy this objective would be classified as an analysis activity within the cognitive processing dimension, and it would be classified as information within the types of knowledge dimension. This classification is quite different from that obtained using the Anderson et al. taxonomy, where it was classified as application within the cognitive process dimension and as procedural knowledge within the types of knowledge dimension. As we shall see in the next section, this difference is an important one in terms of the utility and interpretation of the two newer taxonomies.

In Chapters 2, 3, and 4, we describe the research and theory underlying the various components of the New Taxonomy and how it provides a context or framework for understanding the relationships between mental processes and types of knowledge. In Chapters 5 and 6 we explain how the New Taxonomy can be used in a variety of ways in educational settings. The most obvious use is as a vehicle for designing and classifying educational objectives. The foregoing examples focused on classifying an educational objective. A desired outcome was articulated by a teacher, and the New Taxonomy was used to determine the type of knowledge involved and the mental process applied to that knowledge. Classifying objectives is by nature a post hoc activity. The New Taxonomy can also be used to generate objectives; using the New Taxonomy can ensure that specific types of knowledge are addressed and processed in specific ways.

A second use of the New Taxonomy is as a framework for designing assessments. In Chapter 5 a case will be made that assessments are the logical consequence of well-articulated objectives. That is, an objective establishes a goal, and an assessment helps determine progress toward that goal. Different types of objectives demand different types of assessments. Therefore, the New Taxonomy provides a framework for generating and understanding classroom assessments.

A third use of the New Taxonomy is as a framework for redesigning state and district-level standards to render them more interpretable and useful for students. It is no exaggeration to say that since its inception, the standards movement has permeated K–12 education in the United States. Robert Glaser and Robert Linn (1993) explain:

> In the recounting of our nation's drive toward educational reform, the last decade of this century will undoubtedly be identified as the time when a concentrated press for national educational standards emerged. The press for standards was evidenced by the efforts of federal and state legislators, presidential and gubernatorial candidates, teachers and subject-matter specialists, councils, governmental agencies, and private foundations. (p. xiii)

Glaser and Linn (1993) made their comments at the end of the twentieth century. There is no indication that the standards movement has lost any momentum at the beginning of the twenty-first century. As powerful as the standards movement has been in the United States, it has probably generated as many problems as it has solutions. One of the most glaring is that standards documents are not easily translated into classroom practice. To remedy this, a number of researchers and theorists have called for the revision of standards documents (Ainsworth, 2003a, 2003b; Reeves, 2002). In particular, Kendall (2000) has demonstrated that rewriting standards documents can make them useful tools for classroom teachers. As will be demonstrated in Chapter 5, the New Taxonomy can be used as a framework for recasting state standards documents.

A fourth use for the New Taxonomy is as a framework for curriculum design. The various levels of the New Taxonomy can be thought of as various types of tasks that form the basis of curriculum design. Different types of tasks serve different ends. Knowledge utilization tasks require students to apply knowledge; analysis tasks require students to examine knowledge from different perspectives. In effect, how a teacher arranges and sequences tasks constitutes the curriculum for a class.

A fifth use of the New Taxonomy is as a framework for a thinking skills curriculum. In her book, *Education and Learning to Think,* Resnick (1987) chronicled the need to design and implement a curriculum of mental skills or "thinking skills." She warned that such a curriculum should not be thought of as "higher order," to be addressed only after students have mastered the basics of the knowledge domains via drill and practice. Higher-order curricula are commonly reserved for those students deemed to exhibit exceptional ability. Rather, such a thinking skills curriculum should be embedded in the traditional subject areas at the earliest possible grade levels: "Indeed, research suggests that failure to cultivate aspects of thinking . . . may be the source of major learning difficulties in the elementary school" (p. 8). To this end the New Taxonomy can form the basis of explicit thinking skills and processes that might be taught in the context of traditional subject matter.

In Chapters 5 and 6, each of these uses will be discussed in more detail.

The New Taxonomy, Bloom's Taxonomy, and the Anderson et al. Revision

How then does the model depicted in Figure 1.1 (and its translation to a taxonomy in Figure 1.2) improve on Bloom's efforts? It does so in at least two ways. First, it presents a model or a *theory* of human thought as opposed to a *framework*. Technically, models and theories are systems that allow one to predict phenomena; frameworks are loosely organized sets of principles that describe characteristics of a given phenomenon but do not necessarily allow for the prediction of phenomena. (For a discussion of models, theories, and frameworks, see Anderson, 1990a.) By definition, Bloom's Taxonomy is a framework in that it describes six general categories of information processing. They are certainly useful categories in helping educators understand the multifaceted nature of learning. Indeed, in his 1977 edition of *Conditions of Learning,* Robert Gagne commented on the ingenious contributions of the authors of the taxonomy to an understanding of the various categories of learning. However, Bloom's Taxonomy was not designed to predict specific behaviors (Rohwer & Sloane, 1994) and is, therefore, not a model or theory. The depiction in Figure 1.1 allows for the prediction of specific behaviors within specific situations. For example, given an understanding of an individual's beliefs within the self-system, one can predict the attention that will be paid to a given task and the motivation that will be displayed.

Second (and more important relative to the discussion), the theory presented here improves on Bloom's effort in that it allows for the design of a hierarchical system of human thought from the perspective of two criteria: (1) flow of information and (2) level of consciousness. Here we briefly consider the criterion of flow of information. The criterion of level of consciousness is discussed at the end of Chapter 3, where the details of the New Taxonomy are articulated.

In terms of flow of information, processing always starts with the self-system, proceeds to the metacognitive system, then to the cognitive system, and finally to the knowledge domains. In addition, the status of the various factors within one system affects the status of the various factors within lower systems. For example, if the self-system contains no beliefs that would render a given task important, the individual will either not engage in the task or engage with low motivation. If the task is deemed important but a clear goal is not established by the metacognitive system, execution of the task will break down. If clear goals have been established and effectively monitored but the information-processing functions within the cognitive system do not operate effectively, the task will not be carried out. The three systems, then, represent a true hierarchy in terms of flow of processing.

Given its link with Bloom's Taxonomy, we should also contrast the Anderson et al. (2001) model with the New Taxonomy. To a great extent, it has the same strengths and weaknesses as Bloom's Taxonomy. This is because it was designed (at least in part) as a revision intended to focus the attention of modern-day educators on the original work: "First, there is a need to refocus educators' attention on the original Handbook, not only as a historical document but as one that in many respects was 'ahead of its time'" (p. xxi). Given this well-intended tie to Bloom's Taxonomy, it suffers from the same inherent weakness of that work—the tacit assumption that its levels are ordered hierarchically in terms of difficulty. As Anderson et al. note, "The continuum underlying the cognitive process dimension is assumed to be cognitive complexity; that is *Understand* is believed to be more cognitively complex than *Remember, Apply* is believed to be more cognitively complex than *Understand,* and so on" (p. 5).

Even though the Anderson et al. (2001) taxonomy was designed as a revision of Bloom's Taxonomy, it has some remarkable similarities with the New Taxonomy. Most noteworthy, the two dimensions employed by the Anderson taxonomy are quite similar to the two dimensions employed in the New Taxonomy. The Anderson taxonomy has a knowledge dimension and a cognitive process dimension. The New Taxonomy has a domain of knowledge dimension and a levels-of-processing dimension. At face value both taxonomies classify educational tasks by considering the type of knowledge that is the focus of instruction and the type of mental processing the task imposes on that knowledge. Both taxonomies, then, employ the suggestions of Ralph Tyler (1949b) for stating objectives: "The most useful form for stating objectives is to express them in terms which identify the kind of behavior to be developed in the student and the content . . . in which the behavior is to operate" (p. 30).

However, the dimensions from the two taxonomies have distinct differences. One difference is that the New Taxonomy explicitly addresses cognitive, affective, and psychomotor aspects of learning. Specifically, the psychomotor domain is one of the three knowledge domains and "examining emotional response" is a specific aspect of the self-system (see Chapter 3). As its title indicates, Bloom's original work addressed the cognitive domain. However, a taxonomy was also developed for the affective domain (see

Krathwohl, Bloom, & Masia, 1964), and the intention of Bloom and his coauthors was to develop a taxonomy for the psychomotor domain. The Anderson taxonomy does not explicitly address these distinctions. The authors explain that Bloom's Taxonomy "divided objectives into three domains: cognitive, affective, and psychomotor. This decision has been justly criticized because it isolates aspects of the same objective—and nearly every cognitive objective has an affective component" (Anderson et al., 2001, p. 258). To avoid the criticisms levied at Bloom, the Anderson taxonomy focuses on the cognitive domain: "By intentionally focusing on the cognitive domain, this revision ignores this problem" (p. 259). With this intentional focus noted, Anderson et al. concede that the Metacognitive Knowledge category of their taxonomy "in some respects bridges the cognitive and affective domains" (p. 259).

Another important difference between the New Taxonomy and Anderson's taxonomy involves the placement of metacognition. In the New Taxonomy it is placed above the cognitive processes in that goals are established by the metacognitive system, and whether one has an explicit goal (or not) within a specific learning situation can affect the type and level of cognitive processing that occurs. Thus within the New Taxonomy, metacognition represents a type of processing that is applied to subject matter content. In the Anderson et al. (2001) taxonomy, metacognition is placed in the same dimension as subject matter content, such as factual knowledge, conceptual knowledge, and procedural knowledge. Apparently the deliberation as to where metacognition should be situated involved a significant amount of discussion: "During the meetings that led to the preparation of this revised Taxonomy, we discussed frequently and in great detail both the inclusion and proper placement of *Metacognitive knowledge*" (p. 44). The authors further note that after they had "grappled with [the issue] for a long time" (p. 44), metacognition was placed in the knowledge dimension. It is interesting that they note that it does not fit perfectly within this category: "Of course Metacognitive knowledge does not have the same status as the other three knowledge types" (p. 44).

The third major difference in the two taxonomies is found in the treatment of self-system thinking. In the New Taxonomy it is placed at the top of the hierarchy because it controls whether or not a learner engages in a new task and the level of energy or motivation allotted to the task if the learner chooses to engage. In the Anderson taxonomy self-system thinking is considered an aspect of metacognitive knowledge based on Flavell's (1979) original article on the topic. While Flavell made a viable case for self-knowledge as an aspect of metacognition in 1979, since then a considerable amount of research and theory has established the self-system as a central aspect of human thought apart from the metacognitive system. As Csikszentmihalyi (1990) notes,

> The self is no ordinary piece of information. . . . In fact, it contains [almost] everything . . . that passes through consciousness: all the memories, actions, desires, pleasures, and pains are included in it. And more than anything else, the self represents the hierarchy of goals that we have built up, bit by bit over the years. . . . At any given time we are usually aware of only a tiny part of it. (p. 34)

In summary, while there are some similarities between the Anderson taxonomy and the New Taxonomy, there are significant differences in structure that manifest as significant differences in how the two taxonomies might be used by educators.

Summary

This chapter began with a brief discussion of the nature and impact of Bloom's Taxonomy. It highlighted the problems inherent in its structure (and other adaptations and revisions) while recognizing the strength and breadth of its contribution to educational practice. A model was presented that forms the basis of the New Taxonomy. That model posits three systems of thought that have a hierarchical relationship in terms of flow of processing: the self-system, the metacognitive system, and the cognitive system.