Integrating Instructional Programs Through Dimensions of Learning

The "Dimensions" framework—based on general principles of how learning occurs—can be used to plan instruction, coordinate the use of various programs, and select and plan staff development activities.

Today's teachers have available an abundance of practices that can help them do a better job. Developers have designed and tested programs for maintaining discipline, motivating students, applying learning theory, encouraging cooperative behavior, teaching thinking skills, and so on. Unfortunately, many of these programs are seen as independent of one another, so they become bandwagons, each an isolated movement that lasts until the next one comes along. A teacher tries a little mastery learning for a while, then teacher expectations, then cooperative learning, then teaching thinking, and so on.

What is needed is a framework to integrate these programs: a tool that will help educators see how the various practices relate to one another. With such a framework, teachers will find it easier to blend several different programs, and administrators will be able to select and present various staff development efforts as a unified whole rather than as separate entities.

As we have worked with classroom teachers over the last two years to implement ASCD's Dimensions of Thinking (Marzano et al. 1988), we have begun to see how the types of thinking discussed in that publication can be recast into such a framework.

A Common Thread: Teacher Behavior

A thread running through most staff development programs is that teachers' actions are expected to produce certain types of thinking in students. If a teacher increases her physical proximity to a student who is misbehaving, the student may realize that he is breaking a classroom rule and correct his behavior; when a teacher asks a recall question, it cues students to search their memories for the requested piece of information.

This suggests that if we can identify the main types of student cognitions needed for various learning tasks, we can use the resulting scheme to classify the instructional practices featured in the leading inservice programs.

Some Principles of Learning

Unfortunately, student thinking doesn't occur in neat, easily identifiable categories. To guide our effort, therefore, we have identified four principles of human learning gleaned from current research and theory.
Principle #1: Attitudes and Perceptions Affect Learning
Recent research in motivation (e.g., Harter 1982; McCombs 1986; Weiner 1972, 1983) indicates that a person almost always approaches a task with a set of accompanying attitudes and perceptions that greatly influence performance. When a student sits down to read a chapter in a text for a course she is studying, she approaches the reading task with certain attitudes about the value of the course, the value of the textbook, and her knowledge and ability relative to the content being studied. Some attitudes are conducive to learning, others work against it. If the student believes that the course is quite valuable because it will help her attain a personal goal, her attitude will positively affect her learning. Conversely, if she can't see the value of the course, her attitude will negatively affect her learning.

Principle #2: Learning Involves Acquisition of Two Kinds of Information
Knowledge can be divided into two basic types: declarative and procedural (Paris and Lindauer 1982, Paris et al. 1983). **Declarative knowledge** is concerned with who, what, where, and when; for example, information about who was involved in Watergate, what occurred, and where and when it occurred. Researchers commonly subdivide declarative knowledge into (in order of specificity) facts, time sequences, causal networks, problems/solutions, episodes, principles, and concepts.

**Procedural knowledge** is knowledge of "how to," such as how to write a research paper. Sometimes the components of procedural knowledge are represented as steps that must be applied in a particular sequence; for example, the algorithm for doing long division. Others are much more loosely ordered, for example, the procedure for reading a bar graph.

Content in any field can be subdivided into these two major types. A course in geography might include concepts and principles (declarative knowledge) about the distribution of land, along with processes (procedural knowledge) such as how to read a contour map.

Principle #3: Once Acquired, Knowledge Undergoes Changes
Much recent research sheds light on the specific cognitive operations involved in the initial acquisition of information (for a review, see Anderson 1983, Estes 1982). A key cognitive operation is activating old knowledge and using it to make sense of new information. For example, while watching a documentary on sharks, you use your previous knowledge about sharks to help you make sense of the new information.

Another cognitive operation used when initially learning new information is organizing the information in such a way as to associate it and make linkages with existing knowledge in long-term memory. This not only helps you understand the new information, but it also makes the information more retrievable for use at a later date.

But knowledge stored in the mind is not static. Over time it changes, sometimes quite unexpectedly. Rumelhart and Norman (1981) have identified three types of knowledge change: accretion, tuning, and restructuring. **Accretion** refers to changes in knowledge due to the gradual accumulation of information. **Tuning** refers to the creation of generalizations about existing information. (It is a much more global and radical form of change than accretion.) **Restructuring** is the most global and most radical form of change, involving the creation of entirely new structures either to augment or to replace the old structures.

Common to all theories of knowledge change is the idea that to change an existing knowledge structure, the learner must mentally process the information in new and unusual ways (for a review, see Vosniadou and Brewer 1987). For example, when a student compares two or more concepts in detail, even if he knows them fairly well, he will probably "learn" something new.

Perhaps the most change-producing cognitive function is the actual use of knowledge in meaningful ways. It is one thing to listen to or read instructions for how to use a computer word-processing program but another thing entirely to actually use the program to prepare a manuscript. Only through actual use do most people begin to understand how the system works, as they solve the frustrating problems they invariably encounter.

In summary, the continuum of knowledge development involves cognitive operations that the learner uses to acquire information, other operations that the learner uses to refine the information, and still other operations that the learner can employ to make use of the information in meaningful ways.

Principle #4: Effective Learners Exhibit Dispositions Associated with Critical, Creative, and Self-Regulated Thinking
Based in part on studies of capable thinkers, scholars have identified various qualities of desirable thinking, often referred to as critical and creative thinking. Perkins (1984), Ennis (1985), Glatthorn and Baron (1985), Lipman (1988), and Costa (1985), for example, cite numerous characteristics of "good" thinking, including:

- being aware of one's own thinking at any point in time,
- seeking accuracy in what one does,
- operating at the edge rather than the center of one's ability.

Operations such as these are sometimes referred to as dispositions, because a person who has formed desirable habits of mind is "disposed" to behave in these ways. Dispositions are
not unconscious; good thinkers often strive quite deliberately to meet such standards, asking themselves, “Have I considered other points of view fairly?” “Have I examined enough alternatives?” These habits of mind, while not innate, can be internalized with practice and thus can become part of one’s personality.

**Principles of Learning into Dimensions of Learning**

The four principles of learning can be used to identify types of student thought that need to occur for learning to take place. We might call them “Dimensions of Learning”: types of cognition that facilitate learning. Our portrayal of these dimensions will imply a general pattern or sequence (first one type of thinking occurs, then another), but that should not be taken literally; the dimensions are most useful as a kind of metaphor to guide instruction. As we will demonstrate, they can also be used to help understand how various instructional programs are similar and different.

The five dimensions that spring from the principles of learning are: (1) thinking needed to develop positive attitudes toward learning, (2) thinking needed to initially acquire and integrate knowledge, (3) thinking needed to extend and refine knowledge, (4) thinking needed to make meaningful use of knowledge, and (5) thinking needed to develop desirable habits of mind. Although not a direct translation, these five dimensions are adapted from the ASCD-sponsored framework, *Dimensions of Thinking* (Marzano et al. 1988). Here is a brief explanation of each dimension.

**Dimension 1: Thinking Needed to Develop a Positive Attitude Toward Learning**

As summarized in the first principle of learning, an important factor in any instructional situation is the student’s attitude. We have identified three categories of attitudes and perceptions especially relevant to learning: attitudes and perceptions about (1) self and climate, (2) self and others, and (3) self and the task.

**Dimension 2: Thinking Needed to Acquire and Integrate Knowledge**

The second principle of learning discussed earlier makes a distinction between two kinds of knowledge important to any content area: declarative and procedural. The third principle of learning indicates that a learner changes knowledge over time rather than simply retaining it in the form in which it was first acquired. Putting these two principles together, the second dimension of learning deals with the acquisition and integration of both declarative and procedural knowledge. The mental processes involved in this second dimension can be subdivided into three types: (1) constructing meaning, (2) organizing content, and (3) storing or practicing.

**Acquiring Declarative Knowledge**

*Constructing meaning* refers to using...
what is already known to make sense of what is to be learned. Research, particularly research in reading comprehension, has established numerous strategies that can be used to help students construct declarative knowledge. For example, in K-W-L (Ogle 1986) the learner begins by identifying what she knows about the topic (K = what I already know), and what she would like to know (W = what I want to know). She then reads (listens to, observes) the information and determines what she has learned (L = what I learned). The strategy involves the learner in actively constructing meaning for new information.

Organizing declarative knowledge involves making distinctions among the different types of important information taught in a lesson (e.g., facts, time sequences, causal networks, problem/solutions, episodes, concepts, principles). Making these distinctions is the key to effective learning of declarative information. Specifically, since much of the declarative information presented to students orally and in writing can be organized in a variety of ways, students need to be able to organize the content in a way consistent with the teacher's preferred method of organization. If a teacher does not explain his preferred method of organization before presenting information, the instruction will lack focus and will impose on the learner the burden of trying to figure out how to organize it.

Finally, storing information involves representing it in long-term memory in a way that makes it easily accessible at later times. Operationally, this involves use of techniques such as verbal rehearsal, imagery, mnemonics, and so on.

Acquiring Procedural Knowledge

Two of the processes needed to acquire procedural knowledge are similar to those involved in acquiring declarative knowledge. For example, when first learning how to read a particular type of graph, a learner might help construct meaning by activating what she knows about reading other types of charts or graphs, thus creating an initial model of the process involved. Operationally this might involve making a flowchart showing steps in the procedure.

Storage, however, is different for the two types of knowledge. Whereas declarative knowledge needs to be stored for easy retrieval, procedural knowledge must be practiced to the level of automaticity. Operationally, this means that the learner needs to practice the procedure long enough that he can perform it with relatively little effort or thought.

The second dimension of learning, then, is thinking that helps the learner initially acquire and integrate both declarative and procedural information. Cognitively, this requires the construction of meaning, the organization of information, and either storage or practice, depending on whether the information is declarative or procedural.

Dimension 3: Thinking Needed to Extend and Refine Knowledge

According to the third principle of learning, knowledge continues to undergo substantive change after it has been acquired. One might say that once it has been acquired, knowledge is then available for extension and refinement, which comes about through processing the information in new and unusual ways. We have identified eight such ways (fig. 1).

Each of the cognitive operations listed in Figure 1 can be used to engage the learner in such a way as to change his or her knowledge of the content. In a social studies class, for example, students might compare different forms of government (democracy and dictatorship) to discover new distinctions between them. Similarly, making deductions, such as anticipating future events or conditions based on current information, can help students better understand the information on which the deductions are made. In a science class, for example, students might make deductions about whales based on known principles about mammals and whales.

We might point out that the cognitive operations listed in Figure 1 may also be used when initially acquiring knowledge. For example, when first learning about types of governments, students may engage to some degree in comparison, induction, deduction, and so on. At this stage, however, most such activity will be automatic and relatively unconscious. To extend and refine knowledge, these operations are used consciously, rigorously, and with greater complexity. For example, when students first learn about democracies and republics, they might think casually about similarities and differences be-
between the two. To extend and refine these concepts, however, they would be asked to list these similarities and differences, perhaps using some type of graphic or matrix representation. The difference is a matter of degree, focus, and conscious use.

**Dimension 4: Thinking Needed to Make Meaningful Use of Knowledge**

Our ultimate purpose for teaching the various forms of knowledge is to prepare our students to be able to use that knowledge in meaningful ways. As we know, one of the best ways to ensure that students fully understand the knowledge is to arrange for them to make use of it at the time they are learning it. Because something is meaningful to a person only if it fits with his or her goals, effective teaching involves finding ways for students to relate school knowledge to their personal goals.

We might note that the extending and refining operations listed in Figure 1 are not commonly the focus of personal goals. People don't often compare just for the purpose of comparing; they don't abstract simply for the purpose of abstracting.

Some cognitive operations, though, are more goal-directed. These operations, which we assign to Dimension 4, are briefly described in Figure 2.

For example, we call the process for creating something new composing. Problem solving is a process used to change an unacceptable situation. Decision making is used to select among alternatives, and oral discourse is used to clarify information.

The process of understanding physical and psychological phenomena and then using that understanding to make predictions about future phenomena is scientific inquiry. In school, a student might engage in scientific inquiry to try to understand readers' reactions to certain types of language in a piece of writing. The student could then use that knowledge to predict how various types of readers might react to other texts.

Because these processes are so clearly goal-oriented, teachers can improve student motivation by organizing instruction around them whenever feasible. For example, in a history class, students might compose essays describing the events that led up to the Cuban missile crisis. They might use decision making to analyze Kennedy's reasons for blockading the Soviet missile-bearing ships. Or they might engage in oral discourse to clarify some of the issues around the events leading up to the blockade.

To summarize, the classroom tasks that perhaps have the most potential for changing existing knowledge, especially when they are selected by students, are those that embody the processes listed in Figure 2.

**Dimension 5: Thinking Needed to Develop Desirable Habits of Mind**

The fourth principle of learning discussed earlier holds that good thinkers have certain "dispositions." These "habits of mind" include:

- being clear and seeking clarity,
- being accurate and seeking accuracy,
- being open-minded,
- taking a position and defending it,
- being sensitive to the level of knowledge and feelings of others,
- avoiding impulsivity.

Ennis (1985) has declared that these and similar behaviors are at the core of critical thinking. To illustrate, the learner might note that she tends to "coast" through projects, expending as little energy as possible. To correct this tendency, she might "push" herself on a project, trying to do the very best she can.

The third category of desirable habits of mind are those that characterize self-regulated behavior. From research and theory in metacognition and self-efficacy (Brown 1978, Flavell 1976), we know that people can learn to:

- plan,
- be sensitive to feedback,
- use available resources,
- be aware of their own thinking,
- evaluate the effectiveness of their own thinking.

To illustrate, the learner might make a specific plan of action for an upcoming classroom project. As he implements his plan, he might occasionally note if he is getting closer to or further away from his goal and then make corrections as needed.

One of the biggest challenges teachers face is how to help their students develop the habits of mind associated with critical and creative thinking. Human history leads us to believe that young people develop these qualities by interacting with adults who model such behaviors and by consciously practicing them.

For example, a teacher might lead a discussion on a topic such as why the Supreme Court would uphold a person's right to burn the U.S. flag. Before the discussion, the teacher might remind students of the kinds of behaviors that help make for productive
Fig. 3. Comparison of Selected Programs on the Dimensions of Learning

| Program* | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T |
| Dimension #1: Attitudes | S | S | S | S | S | M | - | - | - | M | M | M | - | - | - | M | S | - | - | - |
| 1. Self and Climate | S | S | S | M | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2. Self and Others | M | S | S | M | M | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3. Self and Task | S | S | S | M | S | M | - | - | - | M | M | M | - | - | - | M | S | - | - | - |
| Dimension #2: Acquiring and Integrating Knowledge | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 1. Declarative | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| a. Constructing Meaning | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| b. Organizing | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| c. Storing | S | - | M | S | S | M | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 2. Procedural | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| a. Constructing Meaning | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| b. Organizing | S | M | S | S | S | S | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| c. Practicing | S | - | M | S | S | M | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Dimension #3: Extending and Refining Knowledge | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 1. Comparing | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 2. Classifying | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 3. Inducing | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 4. Deducing | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 5. Analyzing Errors | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 6. Supporting | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 7. Abstracting | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 8. Analyzing Value | S | - | M | S | S | M | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Dimension #4: Meaningful Use of Knowledge | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - |
| 1. Oral Discourse | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - |
| 2. Composing | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - |
| 3. Problem Solving | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - |
| 4. Decision Making | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - |
| 5. Scientific Inquiry | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - | S | - |
| Dimension #5: Habits of the Mind | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 1. Critical | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 2. Creative | S | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |
| 3. Self-Regulation | M | S | M | S | M | M | S | M | - | - | S | M | S | S | S | S | M | - | - | - |

Key:

-Strong emphasis
-Relative little emphasis
-Moderate emphasis
-Not emphasized

*Program Key:

- B: TESA, Kerman, Kimball, and Martin 1980
- D: Mastery Learning, Bloom 1971; Block 1971, 1985; Guskey 1983.
- Q: Tactics for Thinking, Marzano and Arredondo 1986.
- R: The Skilful Teacher, Saphier and Cooper 1986.
- T: Teaching Styles and Strategies, Hanson, Silver and Strong 1986.

The final dimension of learning, then, is thinking characteristic of critical, creative, and self-regulated people. Like positive attitudes toward learning (Dimension 1), these qualities must be fostered in an indirect but conscious way. Whenever feasible, the teacher should overtly encourage self-regulated, critical, and creative thought.

The thinking we categorize as Dimension 5 is essential to effective performance of the kinds of thinking described in the other dimensions. For example, to make sound decisions, a person needs to exhibit objectivity and attention to evidence; to solve problems well, a person needs to produce imaginative solutions through habits of mind such as persistence and commitment to high standards.

In summary, the five dimensions represent the types of thinking that facilitate effective learning. They can be used to plan instruction that will improve students' success in mastering school content while also developing their cognitive skills.

Using the Dimensions as an Analytical Tool

The dimensions framework can also
be used to analyze and compare staff development programs and instructional practices. Specifically, one can determine which dimensions are emphasized in each program. Figure 3 is an analysis of 20 different programs from the vantage point of the five dimensions of learning.

In the figure, an S in any cell indicates strong emphasis on that dimension, an M indicates moderate emphasis, and a - indicates that the program puts relatively little emphasis on that dimension. This is not to say that the program or practice totally ignores that area (although it might), but only that in our judgment the program or practice does not overtly deal with that dimension. For example, Figure 3 indicates that the ITIP program (Column A) is strong in the “self and climate” and “self and task” components of Dimension 1 and moderate in the “self and other” component of that dimension. It is strong in all aspects of Dimension 2. However, even though some interpretations of the ITIP program use Bloom’s (et al. 1956) taxonomy, which is strong in Dimension 3 (see Column J in fig. 3), the ITIP program per se does not directly address Dimensions 3, 4, and 5, except that it is moderately geared toward enhancing some of the habits of self-regulation in Dimension 5.

In addition to being used as a tool for analyzing various programs, the dimensions can be used as a vehicle for coordinating the use of programs. Specifically, it would seem highly advisable that a school or district select programs in such a way that they cover as many dimensions (with all of their subcomponents) as possible.

The Dimensions in Practice

This article has described the dimensions as a theoretical framework that can be used for instructional planning and program coordination, but it is also a working model that has been field-tested in a number of situations. Specifically, two of the authors (Pickering and Davis) have field-tested the framework as an instructional model in an elementary school for a year. Use of the model appears to increase students’ knowledge of content as well as their ability to use the array of cognitive operations needed to learn academic content. Their field-testing also disclosed that the teachers attended to Dimensions 1 and 2 in their instructional planning and implementation but infrequently addressed Dimensions 3, 4, and 5.

In addition to the field-testing that has already been done, ASCD has established a research and development consortium, which began in October 1989 and will end in August 1991, to test the effectiveness of about 20 strategies that have been incorporated in the model. Some 18 agencies, including 16 school districts from across the country, are participating in the consortium. ASCD also offers training in the Dimensions model as part of their National Training Center program each summer.

A Comprehensive Model for Teacher Education

The Dimensions model, which identifies five general types of thinking needed for effective learning, could eventually become the basis for a coordinated “curriculum” of preservice and inservice teacher education. At this point the model can be used to identify the cognitive focus of a number of existing staff development programs. Such an analysis allows educators to determine how these programs can be used in concert to promote student learning.

References


Authors’ note: We would like to acknowledge the following as co-developers of the Dimensions of Learning framework: Daisy E. Arredondo, Gary J. Blackburn, Deena L. Davis, and Robert W. Ewy.

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