Three Requirements of Effective Instruction: Providing Sufficient Scaffolding, Helping Students Organize and Activate Knowledge, and Sustaining High Engaged Time

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Abstract

We address three principles and methods of effective instruction discussed in the work of Ellis and Worthington—sufficient scaffolding, helping students organize and activate knowledge, and sustaining high engaged time. First, we develop a model of logically coherent instruction that will help teachers apply the principles. Then we discuss each principle and suggest teaching methods derived from each principle.

I. Ellis and Worthington's Contribution, and a Caution

The literature review by Edwin Ellis and Lou Anne Worthington, entitled *Research synthesis on effective teaching principles and the design of quality tools for educators*, is one of the most important documents in education in the past 20 or so years (http://idea.uoregon.edu/~ncite/documents/techrep/tech05.pdf). The document does at least two things.

1. By identifying essential skills, the document provides a solid foundation for teacher preparation and inservice programs.
2. It can help teachers, administrators, and families assess whether **current** school curricula and instruction and suggested **changes** in curricula and instruction are consistent with reliable scientific research.

However, I believe Ellis and Worthington would agree that their work must be used with care. A teacher might say, "This document describes methods of scaffolding. I'll use these in my lessons, and students will learn faster." **Unfortunately, this won't work.** Why? Because the teacher may **not** know **which** methods to use **when** and for **how long** in the learning process. Imagine a skydiver who knows **how** to open the parachute, but does not know **when**. Or an orchestra playing Beethoven's Fifth Symphony with no sheet music. Or

buildings erected by contractors who didn't follow blueprints. Or operations performed by surgeons who didn't use tested protocols. Luckily, all professions, sports, arts, and crafts use various devices to organize actions. These devices are ***models or pictures of a logically progressive sequence of steps leading to desirable outcomes.*** The models show how each step **depends** on what was done before and how each step is **preparation** for next steps. As teachers, we need **a model of what logically coherent *instruction* looks like** so we can properly apply the principles and methods provided by Ellis and Worthington**.** Our next task is to examine such a model.

II. A Model of Logically Coherent Instruction as a Guide For Using Ellis and Worthington's Principles

This section suggests a model that will help us apply principles presented by Ellis and Worthington. [Please skim Table 1.] The model organizes the following ideas.

1. **There are four main forms of knowledge.** From simplest to more complex, these are verbal associations, concepts, rule relationships, and cognitive strategies.
2. **Effective instruction can change learners' skills in at least six ways**: increasing accuracy and speed (or fluency); assembling elemental skills (e.g., phonemic awareness, sound symbol relationships, decoding, asking questions about a passage) into larger wholes (e.g., fluently reading a chapter with high comprehension); properly applying and generalizing skills to new examples; retaining skill over time; and achieving independence from classroom scaffolding (i.e., students' skillful performance no longer requires the teacher).
3. Effective **initial instruction** fosters accuracy, speed, assembling elements into complex wholes, generalization, and application. Later, **expanded instruction** fosters generalization and application, retention, and independence.

Table 1. Forms of Knowledge, Changes in Learner Skill, Changes in Form of Instruction

Forms of Knowledge	Accuracy (Gets It Right)	Speed, Automaticity (Fluency)	Assembling Components into Larger Wholes	Application (Generalization) to New Examples	Retention	Independence
Cognitive Strategies ^ | **Rule Relationships** ^ | **Concepts** ^ | **Verbal Associations:** **a. Discriminations** ^ | **b. Verbal Chains** ^ | **c. Simple Facts**	"4 + 6 means count forward six digits starting from 4." (rule embedded in a cognitive strategy) "Metaphor: "She grasped the handle with eagle's claw." (concept) Paper uses proper format (cognitive strategy using verbal associations, concepts, rules, steps)	Forms of knowledge are internalized, or covertized. Time between steps is shorter; errors are fewer.	Vocabulary words and big ideas (concepts), along with rules of spelling, punctuation, paragraph organization, and style (e.g., the order of an expository paper), are assembled (via a general cognitive strategy for writing papers) into a coherent essay. read sentences ^ read words ^ read sounds ^ distinguish and say sounds	"1/7, 5/16, and 9/6 are fractions. Is 8/12 a fraction?" *"Yes."* Skills at identifying big ideas and rhetorical devices in the *Declaration of Independence*, and skill at explaining the style and purpose of the *Declaration* in terms of its historical context, are applied to an analysis of the *Gettysburg Address*.	Accuracy and speed (fluency), and proper application of component skills and larger wholes are sustained over time.	Accuracy and speed (fluency), and proper application of component skills and larger wholes are sustained in the absence of instruction. The learner is now guided by external events in the task at hand and by relevant covertized knowledge.

Initial Instruction **Expanded Instruction**

Let's study each idea in more detail.

Four Forms of Knowledge

Table 1 shows four main forms of knowledge: verbal associations, concepts, rule relationships, and cognitive strategies. Table 2 gives more detail about these four forms. [Please see Table 2 now, from the bottom.] Note that each **higher form contains lower forms of knowledge.** For example, the cognitive strategy for multiplying three-digit numbers consists of **steps in a routine** (for example, begin by multiplying numbers in the ones column); these **steps are governed by rules** (for example, for carrying); these **rules involve concepts** (such as

multiply, carry); and the whole thing **rests on verbal associations**, such as addition and multiplication facts and counting in a series.

Table 2. Forms of Knowledge: Definitions and Examples

Cognitive Strategies ^ | |	A cognitive strategy is "a series of multi-step associations and procedures that may involve facts, verbal chains, discriminations, concepts, and rules designed to bring about a response or a set of responses to a specified problem" (p. 70). **Regarding application**, the student uses knowledge of verbal associations and concepts (the sounds that go with different letters) and rules (begin with the farthest left letter; say the sound; don't stop; then say the sound on the right; don't stop) to read words. Or, the student examines a passage from a political speech. Using concepts (such as first premise and second premise, relevant and irrelevant evidence, informal fallacies and fallacies of deduction) and rules ("If evidence is irrelevant to a first premise, then the conclusion is indeterminate."), the student states the propositions in the argument embedded in the passage and states whether and why the argument is valid.
Rule Relationships ^ |	"A rule relationship is a proposition that specifies a connection between at least two facts, discriminations, or concepts" (p. 70). **To check knowledge**, the teacher presents the rule: "When pressure increases, temperature increases." She then gives examples of different beginning temperatures and changing pressures, and asks students to **predict** changes in temperature by applying (making deductions from) the rule. **Regarding application**, the teacher presents data on rates of unemployment and corresponding rates of mental hospitalization in cities at different times. Students induce a rule (empirical generalization) that connects the two variables, and state whether the relationship is direct or indirect, linear or curvilinear, weak or strong.
Concepts ^ | |	**Logically**, a concept is "an object, event, action, or situation that is part of a **class** of objects, events, actions, or situations that are the **sam**e, based on a feature or set of features that are the same" (p. 70). Regarding **application of concept knowledge**, students read descriptions of different societies and label then: democracy, monarchy, etc. Or, students answer the question "What sound?" by saying "sss" in the presence of the letter s written with different fonts, sizes, colors, and positions in words and on the page. Or, the teacher says, "Point to the picture of a ball that is **under** the table," and students correctly do so.
Verbal Associations:	Verbal associations are "the connection of a set of specific responses with specific stimuli" (p. 69).
a. Discrimin-ations ^ |	Discriminations are the "recognition of a difference between two stimuli in which the association of a specific response to a stimulus is made in the **context** of **another** stimulus" (p. 67). For example, a student says "mmm" in the presence of m, a, s, and d. Or, a student identifies examples of similes in the presence of examples of metaphors, alliteration, and synecdoche.
b. Verbal Chains ^ |	Verbal chains are a "sequence of successive related simple facts" (p. 68). For example, students are asked to state the days of the week beginning with Monday; to count forward by 10s from 50 to 120; or to name the original Thirteen Colonies.
c. Simple Facts	Simple facts are "The association of a specific response with a specific stimulus" p. 68). Examples include the names of state capitals, the atomic number of different elements, and the number of pounds in a ton. From Kame'enui, E.J., & Simmons, D.C. (1990). *Designing instructional strategies: The prevention of academic learning problems.* Columbus, OH: Merrill

Note also that these **forms are defined by the logical structure of the knowledge itself.** For example, concepts (such as red, granite, and canine) are classes of events sharing one or more features, or samenesses. **We get a concept (we induce it, figure it out, know it) by getting its logical structure**; that is, by noting and identifying the samenesses across examples that differ in other, nonessential ways. **Therefore, this logical structure is what the teacher needs to get across when teaching concepts.** Specifically, students must learn

****_What_** the common (defining) features are.

**To *identify* these common features in examples.

**To see that other examples (nonexamples) *do not have* these features.

The rock samples look different, but they all have mica, feldspar, and quartz. Therefore, we induce, we get, we understand that they are all granite.

Rule relationships also have a logical structure. Rule relationships are **connections between concepts**. For example, infant mortality is higher in lower socioeconomic areas. We get a rule relationship by noting, identifying, and eventually **stating** regularities between one set of events (socioeconomic status in different communities) and another set of events (rates of infant mortality in these communities). Therefore, again, **this logical structure is what the teacher needs to teach when teaching rule relationships.** Students must:

** See that one set of events reliably precedes, follows, is part of, or is not part of another set of events.

** Identify these connections in the midst of other, irrelevant events.

It is important to see that **these forms of knowledge are defined by their *logical* structure and are *not* defined by how persons *use* the knowledge.** We get a concept, for example, by getting its logical structure—that is, **we grasp the samenesses across examples**. How we use knowledge of concepts is another matter. Students might use their understanding of the concept democracy (which means they know the common features that define democracy) to identify examples of democracy, to describe democracies, to invent ideal democracies, to evaluate political systems, and so forth. This distinction between **knowing** a concept and **using** a concept (or any of the four forms of knowledge) is important, because we best ***teach students to* get *knowledge differently from how we teach students to* use *knowledge***. The difference between getting and using knowledge is one difference between

initial and expanded instruction. For example, **much of effective initial instruction is instruction on logic.** Yes, even initial instruction on decoding words is instruction on:

1. The logic of verbal associations. **This** squiggle says "aaa."
2. The logic of concepts. **All** squiggles with the shape m say "mmm."
3. The logic of rules. "If e is followed by a, as in beat, say the name of e and don't say the a."
4. The logic of cognitive strategies. Using all of the concepts and rules in a series of steps called sounding out words.

That is why **the sorts of scaffolding and the methods for helping students organize and activate knowledge during initial instruction (on getting concepts, rules, and so forth) must ensure that students get the *logical structure*.** And this requires carefully planning logically progressive sequences of instructional tasks using a wide range of examples whose arrangement clearly reveals the logical structure—for example, the essential features that **are** a concept, or the essential connections that **are** a rule relationship, or the essential steps, rules, concepts, and verbal associations that **are** a cognitive strategy.

Changes in Learners' Skills

Now let's consider changes in learners' skills. Notice on Table 1 that effective instruction fosters six changes in learners' knowing and using verbal associations, concepts, rule relationships, and cognitive strategies. For example, students will develop firm or accurate knowledge of concepts, use concepts quickly and effortlessly, combine elementary concepts (such as flow, energy, energy transformation) into systems of concepts (such as convection cells), generalize concepts to new examples (e.g., to see weather as convection cells), retain knowledge over the summer, and use knowledge more independently in other, nonschool environments.

Initial and Expanded Instruction

Finally, there are two main stages in instruction: initial and expanded (Dixon, 1989). [Please examine Table 3.] These stages are defined by (1) the sorts of changes you are trying to foster in students' learning; and (2) the amount and nature of teacher directedness. Notice that initial instruction is aimed at accuracy, speed, assembling elements into compounds, and generalization and application. Getting knowledge and accurately and rapidly using knowledge are crucial here. This means that instruction focuses on the logic of the verbal

associations, concepts, etc., to be taught. And this means that *methods of scaffolding, methods for helping students organize and activate knowledge, and methods for helping students stay engaged, must be* ***precisely*** *applied to ensure clarity and be more* ***teacher directed*** *to ensure mastery.*

However, later on, when the objective during **expanded** instruction is applying, generalizing, retaining, and independently using knowledge, the teacher still focuses on the logic of generalizing to new materials, but also teaches and supports students' persistence, long-term memory, planning and projecting activity into the future, self-correction of errors, and finishing. *This means that teaching methods must be altered.* For example, instead of a concept map of convection cells to help students **get** knowledge of rule relationships, students during expanded instruction might use an extended outline format of the strategy for doing **research** on convection cells.

Table 3.
Features of Initial (Earlier) and Expanded (Later) Instruction on a Skill

Initial (Getting Knowledge)	Expanded (Using Knowledge)
1. The instructional objective is relatively **narrow**. For example, the teacher aims for accurate and smooth decoding of new words. This makes it easier to determine whether students have gotten the essential things to be taught.	1. The instructional objective may be **broader**; i.e., may be met by a wider range of student activities, as in writing a good essay. This enables students to combine skills in more personal ways, and also provides opportunities for generalization.
2. New material is presented with **maximum clarity** via models and verbal information. For example, the teacher uses the same wording and instructional formats during similar tasks; pre-teaches new vocabulary; exaggerates important features of an example; makes essential concepts, rules, and steps explicit or conspicuous. "Here is the Rule for renaming… Watch me use that rule…Here I go…"	2. More of the interaction is in the form of discussion, though still focused on objectives. Prompting is **less conspicuous** as students internalize rules and strategies and use them to guide their own attention and application. Devices are used to make long-term plans and to monitor progress over a longer period (e.g., project).
3. The teacher **carefully selects and arranges (juxtaposes) examples** (e.g., of a concept, rule, or application of a strategy) so that students quickly and correctly induce the essential samenesses and differences.	3. The teacher **broadens the range of examples** and expects students to apply earlier skill at identifying samenesses and differences. The teacher also broadens the range of application; e.g., instead of merely defining and identifying examples of figures of speech, students create examples.
4. There is almost **immediate assessment** to determine if the communication (e.g., definition of a concept) was received. "Is this granite?… *Yes.*…How do you know?"	4. Assessment is **broadened** beyond the goal of accuracy. The teacher is also interested in the range of generalization, retention, and ability to sustain skilled performance with less scaffolding (i.e., independence).
5. The teacher **corrects all errors** before going on, and re-checks later to see if students are now firm.	5. Students are taught to identify and **self-correct errors**.

From Dixon, R. (1989). Instructional sequences. Unpublished ms. U. of Oregon.

Let's summarize our model of logically coherent instruction and hint at its implications for using Ellis and Worthington's principles.

1. **There are four main forms of knowledge: verbal associations, concepts, rule relationships, and cognitive strategies.** Lower forms are the elements of higher forms. All four forms are defined by their logical structure. For example, concepts are a class of events with shared samenesses. A rule relationship is a connection among classes of events. So, when students acquire knowledge (for example, understand a rule relationship), they have gotten the logical structure of the rule relationship. But this is not the same as **using** knowledge. For example, students may get the rule relationship, When pressure increases in a closed vessel, temperature increases. But they may use—that is, generalize and apply—this rule relationship in different ways; for example, identify examples and nonexamples of the rule, make predictions, give explanations, guide conduct, or give warnings.
2. The difference between getting knowledge (a logical structure) and using knowledge (that is, action guided by the logic) has direct implications for instruction. Specifically, **the format for teaching students to *get* knowledge (during initial instruction) is different from the format for teaching students to *use* knowledge (during expanded instruction).** Pointing to red objects, naming red objects, and sorting red vs. not red objects is how students might use knowledge of the concept red. ***But you would not teach these concepts by having students point and sort.*** During initial instruction, you would teach the concepts in a more precise, focused, direct, and quicker format that focused on the logic of the concepts—which we will examine later. This initial instruction involves greater **explicitness** in models and verbal information, a **narrower** and **carefully selected** and **presented** range of examples, a narrower range of applications used to check knowledge; and **more prompting and error correction**—***all to ensure that the logical connections are crystal clear to students.*** Later, to see if students got the knowledge or to help them apply the knowledge—the logical structure—you might provide pointing, naming, and sorting tasks that require students to use the concepts.

3. When initial and expanded instruction are well-designed and delivered, learners change in at least six ways: their knowledge is accurate; learners are fast and smooth in application; able and creative at assembling elemental knowledge into larger units; able to generalize and apply knowledge to new situations; learners retain knowledge over time; and do not need continual assistance from the teacher.

Now let us examine the principles and methods of sufficient scaffolding, organizing and activating knowledge, and sustaining high engaged time—in the context of our framework.

III. Providing Sufficient Scaffolding

What is Scaffolding, and What Makes It Sufficient?

Ellis and Worthington's principle 5 is: "Students can become independent, self-regulated learners though instruction that is deliberately and carefully scaffolded" (Ellis & Worthington, 1994, p. 30). What exactly is scaffolding? Here is the definition offered by Kame'enui and Simmons (1999).

> …scaffolding is the help or guidance teachers give students as they acquire new knowledge…In cognitive scaffolding, the goal is for students to 'get it,' or understand the first step in the learning process. The role of scaffolding, however, is to eliminate the problems that could block students from getting it: not understanding or remembering the sound-meaning correspondence in learning to read, for example, or developing a dislike for the activity and giving up (p. 18).

Scaffolding can also help students **apply** knowledge—that is, to eliminate problems that block generalization and application; for example forgetting a rule in a strategy or not carefully attending to progress.

How does scaffolding remove or prevent blocks to getting knowledge? In general, the answer is **Making things crystal *clear* and helping students *hold onto* that clarity as time passes.** [Please see Table 4.] Kame'enui and Simmons (1999) say,

> On new or difficult tasks, scaffolding may be substantial at first and then be systematically removed as learners acquire knowledge and skills. For example, scaffolding can be accomplished through **multiple formats**, including **the careful selection of examples that progress from less to more difficult**, **the purposeful separation of highly similar and potentially confusing facts or concepts** (e.g., mitosis and meiosis); /p/ and /b/ in early letter-sound correspondence learning, the

strategic sequencing of tasks that require learners to recognize and produce a response, or the **additional information** that selected examples provide, such as highlighting the digits in a division problem (p. 18).

Table. 4. Features of Scaffolding

1. Temporary; moves from more to less.
2. Different formats for teaching different knowledge forms.
3. Careful selection of examples, from less to more difficult.
4. Careful juxtaposition of examples to reveal essential features.
5. Strategic sequencing of tasks.
6. Additional information (prompts) to make important details conspicuous.

A last feature of scaffolding is that it is **temporary**. "Students acquiring knowledge should become as self-regulated and independent as possible. To accomplish this, teachers should gradually remove the scaffolding" (Kame'enui & Simmons, 1994, p. 18). Let's look at different kinds of scaffolding starting with scaffolds that organize a larger amount of material and then scaffolds that organize local portions of teacher-student interaction. These are listed in Table 5.

Table 5.
Kinds of Scaffolds Arranged From Broader to More Local

1. The **logical structure** of a curriculum—especially strand based curricula.

2. **Strategic integration across lessons** in the curriculum; e.g., students use knowledge of rhyme, meter, cultural themes, and figures of speech to write poems.

3. **Big ideas**, including

    a. **Central concepts**; e.g., the four arithmetic operations are all forms of counting; the number line; cultural belief in just retribution.

    b. **Propositions or rule relationships**; e.g., weakening of the political state is followed by moral and social disinhibition, and then by violence.

    c. **Theories or models**; e.g., life cycles, convection cells.

4. **Seven features of scaffolding via lesson design**, including

    a. Communication within a lesson or series of lessons is organized around a **logical argument**--deductive and/or inductive.

    b. Knowledge worked on during exercises within lessons is **strategically integrated** into larger wholes.

    c. **Socratic dialogue** is the communication format by which teacher and students work on verbal associations, concepts, rule relationships, and cognitive strategies.

    d. The **frame-model-lead-test/check-verification format** is the communication format by which teacher and students work on verbal associations, concepts, rule relationships, and cognitive strategies.

    e. The careful selection, juxtaposition, and sequencing of **examples**.

    f. **Error correction**.

    g. **Pre-corrections**.

Scaffolding Via The Logical Structure of a Curriculum

Imagine a beginning reading curriculum in which lessons are presented like this. For two weeks the teacher reads to students and asks comprehension questions. "What

did the rabbit say?" Next week she gives each student magnetic letters and asks them to come to the board and spell words. Then the class works on phonemic awareness for a day or two, doing onsets and rimes. mmm/aaat. hhh/at. Next week the teacher has students copy letters, followed by a week on pronouncing sounds. "Say, ffff." There is no rhyme or reason to this. It's nonlogical. No task builds on earlier tasks; no task prepares students for what comes next. Soon, students are disengaged.

However, imagine a curriculum that is a logical and developmental progression. **What students learn earlier is conspicuously integrated with what they learn today, which prepares them for what they learn next.** This sort of curriculum has a predictable structure which, like a melody, carries students along. Remember the first bars of Beethoven's Fifth Symphony. The melody is a scaffold that helps listeners pay attention to, selectively listen for, predict, notice, confirm, and themselves add the next notes to the ongoing melody. Da Da Da Daaa. Da Da Da _____.

Just so, **the logical structure of a curriculum is a scaffold that helps students pay attention to, selectively look for, predict, notice, confirm, and build onto the learning process the tasks that come next.** In other words, the order in the cumulative development and application of knowledge is a scaffold for later learning. This order gives students' participation a clear sense of meaningfulness; their participation leads to mastery and application.

Of course, some curricula are more conspicuously orderly—and these curricula are probably better scaffolds. I am speaking of **strand-based curricula**. A strand based curriculum has the following features shown in Table 6.

Table 6. Features of Strand Based Curricula
1. The curriculum developer—for example, teacher—treats the subject (say, math or reading) as a system of knowledge—a logical system of interconnected cognitive strategies, rule relationships, concepts, and verbal associations.
2. The curriculum developer analyzes the knowledge system into its main forms of knowledge. For example, reading might consist of pronunciation of sounds; hearing, discriminating, and producing the first, middle, and last sounds in words (phonemic awareness); sound-symbol correspondence (This letter says mmm); decoding regular words and irregular words; spelling regular and irregular words; remembering a line just read; identifying the subject and predicate in sentences; identifying the main idea in a passage; and so forth. These are strands in the curriculum.
3. The curriculum developer thinks of specific units of knowledge that go along each strand (for example, different sound-symbol correspondence) and arranges the units along the strand. Principles for arranging items to be learned along a strand include: (a) easier to harder; (b) more immediately useful (such as a, m, s, t, r, and d) to more useful later (such as x, k, y, v, ing); (c) more general (such as the strategy for decoding regular words) to less general (e.g., memorizing words); and from elements (e.g., phonemic awareness and sound-symbol correspondence) to wholes consisting of the elements (e.g., reading words).
4. The last task is to create daily lessons. This is relatively simple. A lesson would be a series of short exercises drawn from items at about the same place along several strands.

Table 7 is the scope and sequence chart for Level I of a strand curriculum called *Reading Mastery* (Engelmann & Brunner, 1995).

Table 7. Scope and Sequence Chart for *Reading Mastery I*

Strands	Taught During Lessons
SOUNDS	1 ——— 160
PRONUNCIATION	1 ——— 48
SEQUENCING	1 ——— 17
Say it Fast	1 ——— 24
Say the Sounds	6 ——— 14
Say the Sounds/ Say it Fast	8 ——— 48
Sounds/Say it fast	13 ——— 26
Say it Fast/Rhyming	6 ——— 25
Rhyming	26 ——— 38
Sound Out	18 ——— 33
Sounding Out Words	28 ——— 160
Reading the Fast Way	60 ——— 160
Regular words	28 ——— 160
Rhyming words	38 ——— 160
Words beginning with stop sounds	63 ——— 160
Irregular words	89 ——— 160
Word build-ups	124 ——— 160
Sounding Out Words	40 ——— 106
Reading the Fast Way	75 ——— 160
Word finding	57 ——— 86
Period finding	87 ——— 90
Sentence saying	87 ——— 106
Quotation finding	94 ——— 106
Question mark finding	98 ——— 103
Reading the title	115 ——— 118
Comprehension	
Picture questions	40 ——— 160
Story questions-Oral	75 ——— 160
Story questions-Written	131 ——— 160
Read the items	151 ——— 160

Engelmann, S., & Brunner, E.C. (1995). *Reading Mastery I Teacher's Guide.* Columbus, OH: SRA/McGraw-Hill. p. 76

By drawing a vertical line through the strands, you can see what is taught in any lesson; for example lesson 28. First is an exercise in the pronunciation strand—in particular, students learn to say eee, rrrr, and nnn. Next is an exercise on sound-symbol correspondence—specifically, a says aaa, s says sss, and m says mmm. Then there are a few exercises on say it fast—specifically, rrrraaat/rat, zzzoooo/zoo, piiicnnniiic/picnic, sss/s, aaa/a. Next is an exercise on sounding out—s a, m a. Next is an exercise on onsets and rimes—mmm _at, fff _un, zzz _ooo.

Here are four reasons why strand curricula are effective.

1. *Skills taught in exercises in each lesson support one another.* For example, pronouncing sounds helps students hear and say sounds in later exercises on onset-rime. Also, pronouncing sounds is *part of* saying the sounds for each letter. In other words, *skills are strategically integrated within each lesson.*
2. *What is taught in earlier lessons is used in later lessons.* For example, elemental skill at saying sounds and blends, sound-symbol correspondence, and applying rules about reading from left to right, are all integrated into and applied to the more complex strategy of decoding words—which begins at lesson 28. In other words, *skills are strategically integrated across lessons*.
3. *Strand curricula make it easier for students to make sense of what they are doing and where that is going because*
   a. Lessons consist of logically related exercises; e.g., learning new vocabulary words and then reading passages containing the new words.
   b. Students move quickly from learning something new to using it.
   c. Elements (e.g., reading sounds) are integrated into wholes (e.g., sounding out words).

   In contrast, lessons in unit based or lesson based curricula may seem unconnected to one another, which must leave students wondering what they are doing and where it is going—which must decrease their interest, attention, and effort—which of course blocks students' getting whatever is being worked on.

4. **Strand organization helps students organize and activate knowledge and sustains high engaged time.** Why? Because when lessons consist of **short** exercises on different knowledge strands it hold attention better than lessons that work **on a lot** of material of only one or two kinds. There is too much time on one thing and too much to learn at once.

In summary, it is wise to consider using already developed and tested strand based curricula in language, reading, math, spelling, remedial reading, history, science, and writing—or at least to create curricula that have strand features. A list of strand curricula is in Appendix 1 at the end of this document. Let's turn to the next form of scaffolding shown on Table 5.

Scaffolding Via Strategic Integration Across Lessons

Strategic integration means carefully building simpler, elemental skills into larger wholes. [Please see the column headed "Assembling Components Into Larger Wholes," on Table 1 on page 3.] According to Kame'enui and Simmons (1999),

> For new information to be understood and applied, it should be carefully combined (strategically integrated) with what the learner already knows and understands to produce a more generalizable, higher-order skill" (p. 21).

Following are examples of strategic integration as a class moves through a curriculum.

1. Elementary grade students first learn a little rote counting (verbal chains) over the course of a few lessons. Next they learn that each numeral stands for a group (1 equals one thing). This is concept learning. Later they learn more rote counting (counting to higher numbers, and counting forwards and backwards), and they learn rational counting (counting groups—one, two, three apples; four five six, seven apples). Next, all these skills are strategically integrated within the larger cognitive strategy of simple addition.
2. Middle school students first learn to identify the **separate** features in narrative writing (e.g., setting, main characters, events, and problem resolution). Later in the course they learn to **use** and to integrate this knowledge in the more holistic task of composing narratives (Kame'enui & Simmons, 1999, p. 21).
3. Throughout the year, high school students in a chemistry class learn the concepts, rules, and steps in the cognitive strategy for conducting an experiment. Also, throughout the year they learn the chemical elements and their properties, solutions,

> compounds, acids and bases, enzymes, and methods of analysis. Periodically, this growing body of knowledge is strategically integrated through application in increasingly complex experiments and writing projects (Romance & Vitale, 2001).

Strategic integration provides a scaffold for later application of knowledge. It does this two ways.

1. It ensures that students are firm on the pre-skills, or elements, before they work on the wholes that **use** these elements.
2. The predictable **pattern** of acquiring and then using knowledge teaches students that what they currently learn and how hard they work are always important to future application.

Now let us examine the third kind of scaffolding on Table 5—scaffolding via big ideas.

Scaffolding Via Big Ideas

Big ideas are another kind of large scaffolding.

What are Big Ideas? Here is what Kame'enui and Simmons say about big ideas. They are

> Concepts, principles, or heuristics that facilitate the most efficient and broad acquisition of knowledge… (They)…
>
> Focus on essential learning outcomes.
>
> Capture rich relationships among concepts.
>
> Enable learners to apply what they learn in various situations.
>
> Involve ideas, concepts, principles, and rules central to higher-order learning. Form the basis for generalization and expansion. (Kame'enui & Simmons, 1999, p. 9)

In other words, big ideas can run through all of a curriculum or through major portions of a curriculum. For example, the teacher **introduces large units** or a series of lessons with a big idea.

> "This next set of poems reveals the big idea that social progress has a price. I'll say that rule again. Social progress has a price. "

She then **introduces daily lessons by reminding** students of big ideas they are working on. **Throughout the lesson** she points out how current materials and tasks are derived from and help elaborate upon the big ideas.

"Today's poem is Blake's "The Chimney Sweeper." In addition to imagery and rhyme, be alert to hear the big idea. Everyone, what **is** the big idea these poems reveal?…"

And she **ends lessons and projects by reminding** students that their work has been guided by and revealed the big ideas. In summary, a big idea helps students see the **relevance** of what they are learning and applying, to **focus** on important features of what they read and hear, and to **organize** in a meaningful way what they are learning. Despite day to day differences in the words, tasks, and materials, one constant is—the big idea.

How to Find and Select Big Ideas. There are least three sources of big ideas:

1. Standards and objectives in a state's or a district's course of study.
2. Research suggesting the importance of certain big themes and skills; e.g., decoding words via knowledge of letter-sound correspondence is the most general and reliable strategy for early reading.
3. The teacher's analysis of the knowledge system—for example, themes in Greek tragedy.

There are at least three kinds of big ideas—central concepts, rule relationships or propositions, and theories or models. Here are examples of each type of big idea.

Central concepts. Central concepts can run through much of a curriculum. They will help students focus on relevant features of materials (i.e., big ideas provide **clues** to what is important) and help students **get the important samenesses** despite differences in examples. A big idea in an early mathematics curriculum might be that the four operations—adding, subtracting, multiplying, and dividing—are all versions of the same thing—namely **counting**. Addition is counting forward by ones; subtraction is counting backwards by ones; multiplication is counting forward (adding) by groups; and division is counting backward (subtracting) by groups (Stein, Silbert, & Carnine, 1997). **The number line might be a graphic organizer depicting the big idea and scaffolding students' applications of it.** Imagine mathematics instruction that begins with rote counting (a verbal chain) and then rational counting (counting groups of objects—3 apples and 4 cookies). Soon children are taught that addition is counting forward, and are taught a simple (and general) cognitive strategy for addition, that involves counting.

6 + 5 = _____ Start counting forward from six. Count five times. Say the last number…*Eleven.* Write eleven in the space. Say the whole thing…

Six plus five equals eleven.

6 + ____ = 11. Start counting forward from six. Count until you get to eleven. Make a mark each time you count. How many marks?…*Five.*

Put that number in the space. Say the whole thing…*Six plus five equals eleven.*

This cognitive strategy uses the big idea that addition is counting forward by ones. When the teacher introduces the next strategy--subtraction--she will tell students that subtraction too is counting—backwards by ones. Students use a strategy very similar to the one for addition.

11 – 5 = _____ Start counting backwards from eleven. Count five times. Say the last number…*Six.* Write six in the space. Say the whole thing… *Eleven minus five equals six.*

Because they are using the same big idea, learning subtraction should be relatively easy—merely another way to count.

Here is another example of a central concept serving as a big idea. In teaching ancient Greek tragedy, or ancient Greek culture in general, a big idea might be **belief in the inevitability of just retribution.** For example, in the *Orestia* plays by Aeschylus, Clytemnestra conspires with Aegisthus to kill her husband, Agamemnon, who sacrificed their daughter Iphegenia before the expedition to Troy. In the first play—*Agamemnon*—the Chorus warns

Among the wicked of mankind
An old crime breeds a younger crime.
Sooner or later, when the appointed day
Comes for the new crime to be born—
A Wrath, a Demon for the house,
Unfightable, unwarrable on, unholy,
A bold, black Ruin for the household—
Truebred to its ancestral type.

The next play--*The Libation Bearers*--continues the big idea. Orestes, the son of Agamemnon, is old enough to avenge his father's murder. He kills his mother. The Chorus says,

The anvil of Justice stands firm-based;
Swordsmith Destiny whets the blade;
And the glorious Avenger, profound in mind, the Fury,
Brings in for retribution a child,
To expiate the old pollution
Of the house at long last.

The big idea is continued in the final play—*The Eumenides*—where Orestes faces the same principle of justice and its consequences. The Chorus says to Orestes,

It is your turn for giving—let me gulp up
The scarlet broth from your living limbs. Let me get
Nourishment out of you, drinking an ill drink.
I will suck your life's blood dry, then hale you below
To pay the painful penalty for mother murder…
For mighty Hades is strict
In calling men to account under the earth.
His mind keeps records, Nothing escapes his control.

By stating this big idea **before** reading the plays, **during** difficult passages in the plays, and at the **end**, the big idea scaffolds students getting and generalizing the big idea from one play to the next, and later using the big idea to compare and contrast different plays.

Big ideas also guide students through reading, discussing, and making sense of American history. What are some big ideas that led people to leave their British homeland and establish colonies here; that led them to find subordination to the British crown legitimate at first and then illegitimate; that led them openly to oppose British domination both in word—the *Declaration of Independence*—and in deed—the formation of militias prepared to fight the British? Among others, these big ideas included the notions, taken from Greek and Roman writers, and from Locke and Rousseau, that human beings have certain God given rights that cannot be nullified by man; that the political state is a voluntary contract for mutual protection in which citizens

agree to abide by laws and obey their governors as long as their governors do not demand more than is justified by norms of fairness; that when the demands of governors exceed norms of fairness, the social contract is violated and void; that therefore, the People (who are now simply Mankind) have the right to establish a new political relationship. These ideas--if **displayed** on the board, **written** by students, **voiced** frequently by the teacher, and then used by students in their own **discussions and papers**--would help students see the common threads running through historical persons, writings, and events.

Propositions or rule relationships. Propositions or rule relationships are another kind of big idea. Without big ideas as scaffolding, Shakespeare's *King Lear* might be misunderstood as a story of a nutty old man, three daughters (two wicked and one sweet but naïve), a thunder storm, and a guy whose eyeballs get squooshed. Likewise, *MacBeth* might be misunderstood as a story about an otherwise decent fellow who couldn't say no to his hardboiled wife, three creepy witches, a ghost, and a yucky beheading. However, a few big ideas—**in the form of *if-then rules* or propositions**—would help students see that both plays—and others of Shakespeare's plays—are **more generally** about what happens when the political organization of society is weakened, either by the King (Lear) giving away his power or by the King (MacBeth) misusing his power. The rule is, When the political organization of society is weakened from the top, interpersonal relationships (for example, parents and children) and feudal relationships become confused and disorderly, personalities disintegrate, the realm becomes chaos, the bestial side of man is released from the moral restraining force of the idea of the realm to wreak destruction, and even nature goes mad.

The same big idea runs through more modern writing, and could be used by a literature teacher to help students see sameness across literature types and centuries. For example, Yeats's poem, The Second Coming, reveals the big idea that things fall apart, and when they do primitive behavior emerges and destroys.

The Second Coming

Turning and turning in the widening gyre
The falcon cannot hear the falconer;
Things fall apart; the centre cannot hold;
Mere anarchy is loosed upon the world,
The blood-dimmed tide is loosed, and everywhere

The ceremony of innocence is drowned;
The best lack all conviction, while the worst
Are full of passionate intensity.
Surely some revelation is at hand;
Surely the Second Coming is at hand.
The Second Coming! Hardly are those words out
When a vast image out of Spiritus Mundi
Troubles my sight: somewhere in sands of the desert
A shape with lion body and the head of a man,
A gaze blank and pitiless as the sun,
Is moving its slow thighs, while all about it
Reel shadows of the indignant desert birds.
The darkness drops again; but now I know
That twenty centuries of stony sleep
Were vexed to nightmare by a rocking cradle,
And what rough beast, its hour come round at last,
Slouches towards Bethlehem to be born?
(W.B. Yeats. *Dial*, November 1920)

Similarly, a major portion of a curriculum on reasoning might be guided by two general rules: (1) Don't take the validity of statements at face value; (2) Examine the evidence, the words, and the generality of the statements. Specific rules to be taught—all examples of the two big idea rules—might be: (1) Just because two things happen around the same time doesn't mean one causes the other thing to happen; (2) Just because you know about a part doesn't mean you know about the whole thing; (3) Just because you know about a part doesn't mean that you know about another part; (4) Just because you know about a whole thing doesn't mean you know about a part; (5) Just because words are the same doesn't mean they have the same meaning; (6) Just because a writer presents some choices doesn't mean there aren't other choices; (7) Just because events have happened in the past doesn't mean they'll always happen. These rules, as big ideas, help organize instruction and students' knowledge in a curriculum called *Corrective Reading: Comprehension* (Engelmann *et al*., 1998)

Theories and models. Theories and models are a third kind of big idea. Theories and models consist of **several interconnected concepts and rule relationships**. Examples of theories and models to scaffold students' acquisition and application of knowledge include the following:

1. Life cycles. Birth, growth and development, reproduction, decline, death.

2. Cycles in civilizations. Emergence, growth and differentiation (e.g., division of labor, social classes), exhaustion, transformation. In fact, this is the theory that runs through Arnold Toynbee's massive work, *A study of history*.
3. Cycles in societies and in smaller social formations. Challenge, response, and consequence. This model runs through the two volume curriculum called *Understanding U.S. History* (Carnine, Crawford, Harniss, & Hollenbeck, 1994). The big ideas are presented early in the curriculum, are used to introduce and later to summarize events and periods, and are used by students to organize answers to questions.

Note that big ideas could all be presented **visually as concept maps** (page 70), which also help students to organize and activate knowledge. Now let's turn to scaffolding via lesson design.

Scaffolding Via Lesson Design

There are at least seven features of effective scaffolding in lesson design. From larger to smaller portions of lessons, these are shown on Table 8.

Table 8. Ways of Scaffolding Via Lesson Design

1. Communication within a lesson or series of lessons is organized around a logical argument--deductive and/or inductive.
2. Knowledge worked on during earlier exercises in a lesson is strategically integrated into larger wholes later in the lesson.
3. Socratic dialogue is the communication format by which teacher and students work on verbal associations, concepts, rule relationships, and cognitive strategies.
4. Frame-model-lead-test/check-verification is the communication format by which teacher and students work on verbal associations, concepts, rule relationships, and cognitive strategies.
5. The selection, juxtaposition, and sequencing of examples.
6. Error correction.
7. Pre-corrections.

Let's begin with the first aspect of scaffolding via lesson design on Table 8.

The whole lesson, portion of a lesson, or series of lessons is a logical argument. Imagine lessons on pre-Revolutionary America in which the teacher merely presents events in historical order. At best, students learn verbal associations; namely, **simple facts** (such as when the British fired on the Minutemen at Lexington Green and who wrote the Declaration of Independence), and **verbal chains** (such as reciting names of leading patriots--Samuel Adams, John Adams, Joseph Warren, Paul Revere, Alexander Hamilton). This is better than nothing. But if lessons were organized (scaffolded) as a logical argument, students would learn more and at a higher level for the same investment of time.

Organizing instruction as a logical argument is useful when the task is to make sense of a complex set of events.

1. The **events** might be embedded in historical or contemporary documents; e.g., letters written in ancient Rome, plays, reviews of the literature, newspaper articles, data bases on social and economic development.
2. The **sense** is the big idea (model, theory, rule relationships, concepts) that students use to understand the events. (See page 19.) For example, what is the big idea that helps to make sense of *King Lear*? What is the big idea that helps make sense of the letters Cicero and his friends wrote before and after the assassination of Caesar? In other words, how did these Romans understand what was going on? And what is the big idea that makes sense of rising rates of crime, mental illness, and family breakdown as traditional societies become urban and industrial?
3. The sense **making** is either a deductive format for showing how the events are subsumed under the big ideas, or an inductive format for showing how the big ideas **emerge from** the events.

As said, **there are two main ways to organize lessons as logical arguments: deductive and inductive.** The deductive style **begins with a premise**—a big idea; for example a theory or model or rule relationship. The rest of instruction shows students examples of events subsumed under or explained by the big idea. In contrast, the inductive style **begins with specific events**, not with a big idea. The task for students and teacher is gradually to **construct** big ideas--concepts, rule relationships, and eventually models or theories--that account for the events. In other words, the deductive form begins with a

general idea and then examines specifics. The inductive form begins with specific events and ends with a general idea that explains the specifics.

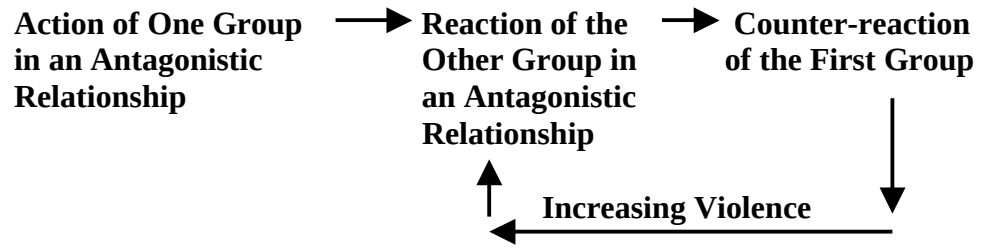
Of course, the two styles really go together in a circle. For example, if (using the inductive style) the class develops a model to explain a set of historical events, students would later (in deductive fashion) apply that model to other historical events to see if the model still works. By examining these new events, students may discover (inductively) that the model has to be altered. So, **teachers do not have to use one style—deductive or inductive--or the other.** They will use both over time. They merely have to decide whether it is best for students to **begin** with a big idea (a kind of advanced organizer) or to begin with the specific events. Let's examine the deductive and then the inductive form for organizing lessons as logical arguments.

Lessons organized as deductive arguments. Here is how lessons could be organized as a **deductive argument**. [Please see Table 9.] First, the teacher **reviews** previous relevant material (for example, interference of the British homeland in Colonial affairs) and introduces a few **new concepts** needed for the lesson (for example, Whigs and Tories). Then the teacher introduces the major portion of the lesson by **displaying and explaining a concept map of a big idea**—say, a model of escalating violence—as shown on Figure 1.

Table 9. Deductive Organization of Lessons

1. Review previous relevant material.
2. Introduce a small number of new concepts needed for the lesson.
3. Introduce the major portion of the lesson with a big idea; e.g., displaying and explaining a concept map. This is the major premise for the rest of the lesson or series of lessons.
4. Examine specific events—which are to be understood as examples and as supporting evidence for the big idea.
5. Check students' understanding by asking them to identify and to discriminate additional relevant and irrelevant events.

Figure 1. A Model of Escalating Conflict as Each Group Reacts to the Actions of the Other Group



This big idea is the first (or major) premise in a deductive argument that organizes lessons on the Pre-Revolutionary period.

Teacher and students next read documents and discuss the sequence of events leading to the Revolutionary War. These events are understood as examples and as supporting evidence for the big idea, or model. Students now see which events were directly part of the action/reaction cycle (the Stamp Act, the Boston Tea Party, the Boston Massacre, the militia storing arms in Concord, combat between the British and the Minutemen at Lexington and then Concord); which events helped move the process along

(the hot temper of Patrick Henry and the persuasive writing of Thomas Paine); and which events were irrelevant to this process. In summary, the deductive argument format scaffolds students' interest and engagement, getting the significance of events, and organizing these events into a larger scheme.

In later portions of the lesson and in later lessons the teacher **checks** students' understanding by asking them to read more materials and to judge whether new events are relevant or irrelevant to the big idea. And in still later lessons, the teacher helps students **generalize and apply** the big idea to other historical periods and events, such as Shay's Rebellion and the Civil War. "Remember our model of escalating conflict between the British and the Colonists. Let's review it… Now we will use the same model to study Shay's Rebellion."

Lessons organized as inductive arguments. However, the teacher could use an inductive style of argument to organize instruction. [Please see Table 10.]

Table 10. Inductive Organization of Lessons

1. Review previous material and introduce new vocabulary.
2. Present, read, and discuss specific events. Teach that these are examples of concepts.
3. Present, read and discuss more events that are examples of the same, and new, concepts. Assist students to identify and state rule relationships that connect these events.
4. Develop general rule relationships, models, or theories to account for the specific events (instances of the general). Therefore, the big ideas are the conclusion of the study.

In the inductive style, after reviewing previous material and introducing new vocabulary, teacher and students read and discuss **specific** writings, events, and persons in the pre-Revolutionary War period. The teacher introduces and teaches the concepts (not just the words) action, reaction, and counter-reaction, and asks students to begin to see the specific events as **examples** of these concepts. "Can you see the storing of arms in Concord as a reaction to British actions? If so, what actions? Can you see the British

marching to Lexington as a reaction to what the Colonists were doing?" As more events are discussed and added to the model, the teacher asks students if they can find **connections** (rule relationships) among the actions and reactions; for example, increasing anger, increasing numbers of citizens involved in the rebellion, increasing formalization of groups and leadership that become the basis for forming a new nation, preparation for and actual violence. Once students induce or discover these rule relationships, the teacher prompts them to find more examples of the action-reaction rule relationship in later historical events. Finally, after discussing the outbreak of the War, the teacher helps students develop a **general model** (concept map) depicting the whole process—namely, the model of escalating conflict. (Please see page 71 for an example.) The model might be represented with a diagram such as Figure 1. Again, the teacher helps students to apply the model to other historical events and periods. Now let us examine the second aspect of scaffolding instruction via lesson organization shown on Table 8; namely, strategic integration of elemental knowledge into larger skills.

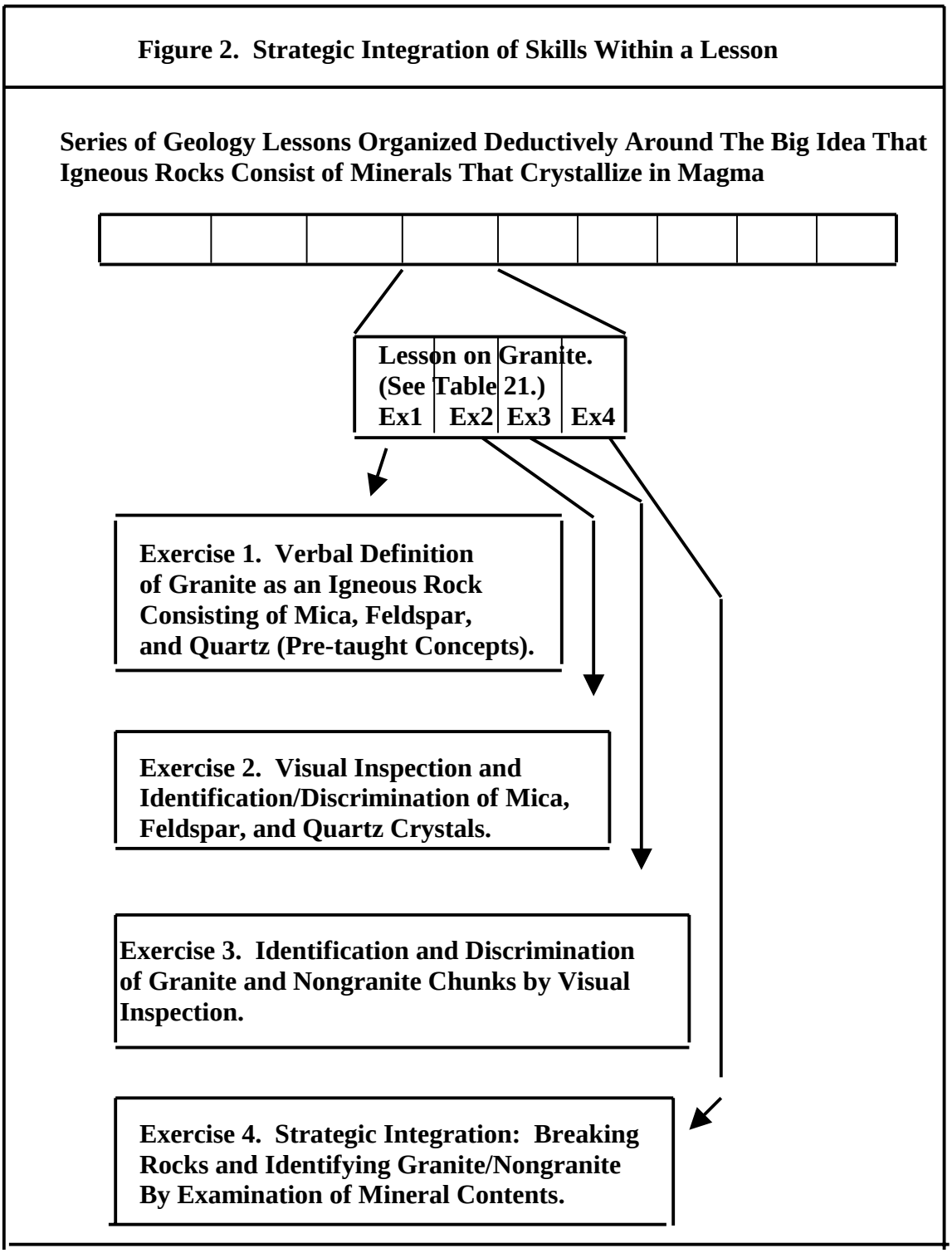
The lesson strategically integrates knowledge reviewed and taught in different exercises into a larger whole. Some lessons are not fashioned as arguments. However, they can still have the logical structuring called strategic integration. We already discussed how there should be strategic integration **across** lessons in a curriculum. (Please see pages 18-19.) Earlier taught skills are combined with later skills to produce a larger whole. This same arrangement can be **within** lessons. That is, the lesson is organized as a series of short exercises--each focusing on elemental knowledge (e.g., new concepts and rule relationships, additional steps in a cognitive strategy). By the end of the lesson, this elemental knowledge is assembled into a larger whole, such as solving a problem. For example,

1. The first 15 minute exercise in a history lesson (during the sequence on Revolutionary America) might be **to define and examine the historical roots** of **concepts** such as inalienable rights, The People, colony, tyranny, and social contract (e.g., in the Roman Republic, the Magna Carta, the writings of John Locke and Jean Rousseau).

2. The next exercise in the lesson is to define and discuss **rhetorical devices in persuasive writing**; for example, repeating evocative phrases so that readers are carried along.
3. The lesson ends with strategic integration; that is, the class uses the elemental concept knowledge to analyze the philosophical foundations and rhetorical devices in *The Declaration of Independence*.

Please note that organizing lessons around deductive and inductive arguments and organizing lessons around strategic integration **work perfectly well together.** For example, a series of lessons might be organized as an argument. However, lessons or portions of lessons in the series might involve strategic integration; e.g., learning elemental skills for defining and identifying rocks and their mineral constituents, and then integrating these skills by breaking rocks apart and identifying them. This is shown on Figure 2.

Figure 2. Strategic Integration of Skills Within a Lesson



This strategic integration within a lesson does several things: (1) students understand that what they learn early in the lesson is relevant to what they learn next; (2) strategic integration of elemental knowledge yields higher-order skills; and (3) application of elemental knowledge **within** the larger whole (e.g., experiment, writing project) is a naturalistic way of providing practice that sustains skill. Now let us turn to another scaffolding feature of lesson design—namely, teacher-student communication formats, which include the Socratic dialogue and the model-lead-test/check-verification format.

The Socratic dialogue as an instructional/communication format. Imagine Socrates walking around the agora, or marketplace, in ancient Athens. He hears citizens discussing the just society. Frustrated by their errors of reasoning (which he considers one cause of social disorder and human misery) he instructs them.

> "By the gods, you are ignorant. I'll **tell** you what is wrong with how you think, and what justice is."

Yet, he has failed. Even if listeners can say the definition of justice, they have not learned anything about the right reasoning **strategy** for assessing beliefs and then developing a better definition of justice. That is perhaps why Socrates did not tell anyone his definitions, but engaged them in a form of conversation—the dialogue or *elenchus* or dialectical method—that taught them the strategy for self-analysis and concept definition. Examples of this method are found in Plato's *Republic*, *Meno,* and *Symposium*, among other dialogues. Table 11 identifies main features of the Socratic dialectical method.

Table 11. Features of Socratic Dialectical Method as an Instruction Format

1. Ask questions that probe students' verbal associations, concepts, rules, and explanations--which could be their interpretation of a story or poem, their understanding of history texts, their explanations for natural phenomena derived from reading or experimentation. "State your belief as a rule relationship." "What concepts are you defining?" "What exactly is your definition of ..." "Summarize your argument as a series of propositions."

2. Ask questions about students' current knowledge in a way that requires them to use certain rules of reasoning. For example, are definitions clear? Have they reversed cause and effect? Have they overgeneralized? Have they missed important evidence that contradicts their beliefs? "How do you know that?" "Is that the only explanation?" "What evidence is there to support your statement?" "Are there any other possible explanations?" "What else might you need to consider?" "What is your definition of...?" "Is that a good definition?" "What are the consequences of actions that are guided by your belief?" "What logical fallacies are you committing?"

3. Have students revise their knowledge and repeat step 2. "How can you improve your definition of ...?" "State an alternative explanation." "Identify two other possible variables that might be included in your explanation." "What additional information do you need to get?"

In the Socratic dialogue, **Socrates asks a question**. "What (do you think) is justice?" His conversation partners draw on their beliefs (e.g., concepts and rule relationships) and answer. Socrates **repeats their answer** and affirms that it is a good try. Then he asks them to **consider the consequences** of acting on their definitions and rules. For example, one student answers, "Justice is paying what you owe." Socrates then gives a **hypothetical situation**. " Well, if a person lends you weapons when he is sane and asks you to return then when he is mad, you would be obliged by your definition of justice to give them back. But wouldn't it be unjust to give weapons to a madman?" Either his students see the contradiction or Socrates points it out—that is, how their definition (of something good—justice) will have bad consequences. Finally, Socrates states what has been learned: "So, justice cannot be (i.e., cannot mean) paying your debts." He asks his students to try again. With repetition of this format, Socrates's students learn that the search for truth is orderly; it

is bound by rules of reasoning; and they must accept the judgment of reason regardless of their personal preferences and social attachments. The continual challenge embedded in the dialectical method sustains engagement; it also teaches steps in the reasoning strategy.

The Socratic format can easily be used in lessons organized as deductive or inductive arguments. For example, as students try to **develop** concepts, rule relationships, or models, or when students try to **explain** events by subsuming them under a concept, rule relationship, or model, the teacher asks probe questions such as "What is your definition of provocation?" Or, " In what way was the Boston Tea Party a provocation to the British?" Or, "You say Thomas Paine's *Common Sense* radicalized members of the public. Are you implying that that was the **only** factor that radicalized the public?" In other words, **the Socratic method can be used periodically to *challenge* students to *examine* what they think they know and to *improve* the way they *apply* what they know. *The general question is simply, "How do you know?"***

It is important to understand that some persons and schools say they use the dialectical method—they might call it a "Socratic seminar"—but they are **not** using it. Instead, they are doing the intellectual work **for** students--telling them what is wrong with their reasoning and giving them better ideas--or they are letting students talk without continual challenge to examine definitions, evidence, and the adequacy of conclusions. There is basically no logical scaffolding in this pseudo-Socratic seminar. It does not lead to clarity and precision of concepts, rule relationships, and cognitive strategies. Now let us examine another communication format that effectively scaffolds instruction.

Frame-model-lead-test/check-verification as an instructional/communication format. This general format may be used in **any subject**. It is highly **focused** on the knowledge task at hand. It moves at a **brisk** pace. During initial instruction it provides sufficient learning **opportunities** for students to get the verbal associations, concepts, rule relationships, and cognitive strategies being taught. Later, during expanded instruction, it is used to help students apply knowledge (Kame'enui & Simmons, 1990). Finally, this format fosters high **engagement**—because it focuses attention, moves quickly, and ends with firm knowledge. ***So, if you want absolutely to ensure that all students get and skillfully use knowledge, if you want students with learning difficulties to have a high rate of success, and if you want faster learners to move as fast as they can, then use this format—not every minute, but when***

precision and mastery right now are the aim. Steps in the frame-model-lead-test/check-verification format are shown on Table 12.

Table 12. Steps in the Frame-Model-Lead-Test/Check-Verification Format

Frame.	The teacher states the learning task at hand.
Model.	The teacher provides information (e.g., reveals the logical structure of a verbal association, concept, rule relationship, or cognitive strategy, or shows how to apply this knowledge) verbally or through demonstration. If needed, the teacher repeats the model to make sure all students heard or saw it.
Lead.	The teacher and students say the information or perform the routine together—several times if needed to ensure that all students do it correctly; that is, are firm.
Test/Check.	Students perform the task independently, several times if needed to do it correctly. This is a test or check of whether the students have gotten it. It tells the teacher whether she communicated clearly, the students' pre-skills were firm before this task, and the students were properly attending and trying.

Verification. The teacher provides specific praise—stating what the students learned.

Table 13 shows how the frame-model-lead-test/check-verification format provides effective scaffolding.

Table 13. How the Frame-Model-Lead-Test/Check-Verification Format Provides Scaffolding

1. It provides information in small, learnable amounts.
2. It moves from more teacher directed (the model plus prompts, such as pointing and exaggerating gestures and voice) to less teacher directed (students respond independently).
3. It quickly moves from getting knowledge to using knowledge.
4. It provides sufficient practice on a verbal association, concept, rule relationship, or cognitive strategy (one or more steps) to ensure that students are "firm" before the teacher adds more material.
5. It moves at a brisk pace, which captures and sustains attention and facilitates recall.
6. Students' familiarity with this format orients and guides their behavior—attention, cognitive rehearsal before acting, persistence until they all get it.

Table 14 gives an extended example of the frame-model-lead-test/check-verification format.

Table 14. Extended Description of the Frame-Model-Lead-Test/Check-Verification Format

Frame.	Now we're going to read words the slow way.
Model.	Everyone, listen. [Gets attention first.] I'll show you how to read this word (**Points** to word on board) the **slow** way. [Preparation by stating the task. Uses a **visual** prompt to focus attention and a **verbal prompt** to distinguish between reading the slow way and the fast way.] Get ready. [Gives think time to orient to the model.] sssnnnaaaap. [The model. Moves her finger under the word and sounds it out.]
Lead.	Everyone [attention], read this word [points] **with** me, the **slow** [prompt] way. Get ready. [Think time]… (Signals students to respond by moving her finger under the word.) *sssnnnaaaap.* Again. Get ready… *sssnnnaaaap.* [Repeats another time to ensure that all students respond promptly, together, and correctly.]
Test/ Check	**Your turn** to read this word (points) the slow way. Get ready… (Signals students to respond by moving her finger under the word.) *sssnnnaaaap.*
Verification.	Yes, sssnnnaaaap. I love the way you said each sound without stopping.

Table 15 describes additional features of the frame-model-lead-test/check-verification format.

Table 15. Additional Features of the Frame-Model-Lead-Test/Check-Verification Format

1. The teacher makes sure all students are **paying attention before** she provides the model. "Everyone, look." Or, "I have to see everyone looking up here at the board….Thank you." The teacher uses a variety of **prompts** to ensure students are attending to and getting precisely the right information throughout the interaction. For example, the teacher moves her finger beneath each letter she is sounding out, to make sure students look at each letter the moment the teacher says its sound.

2. The teacher **prepares** students to hear, see, and act by **stating the type of knowledge task** they are working on. "Here's a new sound" or "The next thinking operation is statement inference."

3. Wording is clear, precise, and to the point—to ensure understanding. For example, **all important concepts are pre-taught**: before defining democracy as a political association involving rule by the people, the teacher would pre-teach political association, rule, and people. There is no unnecessary verbiage. The same wording is used when teaching the same sort of task. "First word (points to word on a word list). What word? *Malleable.* Next word? What word. *Convince.* Next word. What word? *Divulge.*

4. The teacher **repeats any of the frame-model-lead-test/check steps if needed** so that all students have attended and responded firmly—that is, they seem to have gotten the communication—before she goes on.

5. The teacher uses a **gesture to signal students to respond** when it is their turn. If students are looking at the teacher (e.g., the teacher is at the board), the "do it" signal could be a "hand drop"; that is, the teacher's hand is raised when she says "Your turn to read these words the fast way. Get ready…." Then she drops her hand and students start reading.

   However, if students are **not** looking at the teacher (e.g., they are reading passages from a book), the teacher could tap on her book to give the "do it" signal. For example,

   Teacher: Everyone, what's the figure of speech in the line, 'And what rough beast, its hour come round at last, Slouches towards Bethlehem to be born'? Think about it… Get ready…" [Taps her book to signal "do it."]
   Students: Metaphor.
   Teacher Yes, metaphor. [Verification.]
   How do you know? [Asks for the definition previously taught.] Think…Get ready… Taps her book.]
   Students: A metaphor is a word or phrase that usually has one meaning is used to talk about another thing, but the comparison is not directly stated.
   Teacher: Yes, the comparison is **not** directly stated. Excellent definition of metaphor.

6. These signals help students respond quickly to (i.e., act on) new information (which aids getting it), and help students respond as a group, as discussed next.

7. The teacher **first** calls on the whole group to respond as one. "Your turn to state the rule about pressure and temperature. Get ready." Choral responding enables the teacher to determine that **each** student has gotten the communication. If she called on students individually, she could not tell if a student was merely copying the students who came before. Choral responding also makes instruction move quicker (imagine how long it would take to check each student), so that more is covered. Finally, choral responding gives students the sense of both individual and group mastery in a learning community, which fosters an obligation to try to do well and not disrupt the group's learning.

8. After group turns, the teacher calls on individual students—especially students who made errors during the choral responding.

The frame-model-lead-test/check-verification format takes perhaps 30 seconds or less to enact. It is used to teach small units of knowledge—for example, one simple fact; one verbal chain (or portion of a long verbal chain); one new concept (not a whole set of concepts); one application of a rule relationship; one example of a cognitive strategy that has a few steps (e.g., two-digit multiplication); or just one step in a complex cognitive strategy (e.g., multiplying numbers in the ones column). However, using this format over a series of exercises within a lesson and series of lessons will teach students a large unit of knowledge; e.g., to read sounds and words, to state steps in an experimental protocol, to enact a complex mathematics strategy, to define the offices in the Roman Republic (consul, censor, quaestor, tribune, praetor, etc.). **And they will do so accurately, quickly, and confidently.**

In addition, **teacher wording** in the frame-model-lead-test/check-verification format is slightly different depending on what is taught--verbal associations, concepts, rule relationships, or cognitive strategies. Following are examples. Student responses are *in italics*.

Table 16. Teaching Simple Facts With Frame-Model-Lead-Test/Check-Verification Format

Framing: Yesterday we studied the Battle at Marathon. Everyone. Who fought in the Battle at Marathon? Get ready? (Signal) *The Greeks and Persians.*
Yes, the Greeks and Persians. What was the date of the Battle at Marathon? Julian. *490 BC.*
Excellent. 490 BC.
Who won? Amelia. *The Greeks.*
Correct again. The Greeks. This class is so smart.
Now we will study another great battle in the Persian Wars. The Battle at Thermopylae.

Model: Everyone, listen. (Pause) Here's a new fact. The Battle at Thermopylae was fought in 480 BC.

Lead: Say that fact with me. Get ready. (Signal) *The Battle at Thermopylae was fought in 480 BC.*

Test/Check: When was the Battle at Thermopylae? Get ready. (Signal) *The Battle at Thermopylae was fought in 480 BC.*

Verification: Yes, the Battle at Thermopylae was fought in 480 BC.
[Later, students would learn about the size and composition of each army, battle strategy, the immediate outcomes, and the place of the battle in the larger historical context.]

Note that this format simply and quickly taught the logical structure of a fact; it firmly taught the **association** between a date and an event. However, the teacher must provide opportunities for students to **apply** this knowledge; for example, when comparing and explaining the outcomes of the Battle at Marathon (which the Greeks won), the later Battle at Thermopylae (where the Greeks were overrun), and the later Battle at Platea (which the Greeks again won).

Table 17. Teaching Verbal Chain With Frame-Model-Lead-Test/Check-Verification Format

Framing: You know that somatic cells reproduce themselves by making copies. They make copies by dividing. Everybody, what is the name of the process of cell division in somatic cells? Get ready. (Signal) *Mitosis.*

Excellent remembering. Mitosis. Now mitosis, or cell division, happens in phases. Get ready to learn the phases of mitosis. What are we going to learn? (Signal) *The phases of mitosis.*

Model: There are six phases of mitosis. Here they are, starting with the first phase. Get ready. (Pause)

Interphase, prophase, metaphase, anaphase, telophase, cytokinesis.
[These could be written on the board and written by students.]

Lead: Say the six phases of mitosis with me. Get ready. (Signal) *Interphase, prophase, metaphase, anaphase, telophase, cytokinesis.*
[This may be too long a series to do all at once. The teacher might teach the series in smaller chunks—the first three; the next three; and then all six.]

Test/Check: All by yourselves. Get ready. (Signal) *Interphase, prophase, metaphase, anaphase, telophase, cytokinesis.*

Verification: Excellent remembering all six phases of mitosis.
[Later, students learn the definition of each phase, how each phase looks, to generalize this knowledge to new examples by identifying and discriminating the phases when they are shown ("What phase is this?") or defined ("What is the phase when two new nuclei form?).]

Here, again, the frame-model-lead-test/check-verification format was used during initial instruction to ensure that students got the skills of attending to, remembering, and saying the verbal series. Later, during expanded instruction they will apply this knowledge in various ways.

Table 18. Teaching Verbal Discrimination With Frame-Model-Lead-Test/Check-Verification Format

Frame/Model: We will learn to say the sound for this letter (Points to letter m on easel.) I will point to the letter and say the sound. My turn. (Teacher places finger right below the letter m on the easel.)
This letter says the sound mmmm.
Listen again. This letter says the sound mmmm.

Lead: Say it with me. (Points to the letter m). Get ready. (Signal) *mmmm.*
Again. (Signal) *mmmm.*

Test/Check: All by yourselves. (Pause to make sure students are attending.) What sound? Get ready. (Signal) *mmmm.*

Verification: Yes, mmmm.

Individual Test/check of Students: Jose', your turn to say the sound. (Teacher points to letter.) Get ready. (Signal). *mmmm.*

Verification: Yes, mmmm. I love the way you were looking right at the letter.

Individual Test/check of Students: Your turn. Karen. (Teacher points to letter.) Get ready. (Signal). *mmmm.*

Verification: Yes, mmmm. Good following my finger.

Discrimination Testing Sequence: (Teacher has easel with letters [s, m, a] in different sizes, colors, and styles, and pictures [dog, hat, tree] for students to discriminate as a way to test whether they have gotten the communication.)

Everyone, look up here. Watch my finger. (Points to the letter m.)
Everyone, what sound does this say? *mmm.*
(Points to picture of tree.) What is this? *A tree.*
Yes, a tree.
(Points to s on easel.) What does this sound say. *sss.*
Excellent!
(Points to picture of dog.) What is this? *dog*

(Adapted from Kame'enui & Simmons, 1990, pp. 139-40).

Table 18 is an example of the format being used to establish solid knowledge of sound/symbol correspondence. It will be used to teach other sound/symbol correspondences. Then, this **elemental** knowledge will be strategically integrated into the larger cognitive strategy for

sounding out whole words. This format ensures that students will have mastered the elements so later instruction will be effective.

Table 19. Teaching Simple Concept With Frame-Model-Lead-Test/Check-Verification Format

Some concepts are fairly concrete; e.g., color, position (on, up, under), polar (hot/cold), comparative (wider, steeper, faster), fruit, toys, and shapes. They do not need to be defined by other concepts. It is enough to provide concrete examples. However, as students' become more sophisticated and knowledge systems become more complex, we teach that simpler concepts are part of **networks** of relationships. For example, colors are part of the light spectrum, and differ in wavelength. Therefore, we begin to define color concepts in terms of other, more complex concepts and rule relationships.

Framing: You all know what a circle looks like. (Points to circle on the board.) Everyone. What shape is this? *Circle.* Yes, circle. (Points to another circle on the board.) And what shape is this? *Circle.* Yes, circle. (Points to a triangle on the board.) Is this a circle? **No.** Correct, this is **not** a circle.
Now we will learn a new shape—**square**. Everyone, what shape are we going to learn? *Square.* Yes, square. Here we go.

Model: (The easel has six or so squares differing in size, color, and thickness of lines. It also has several circles and pictures of objects.) Everyone, look. (The teacher points to one square.) This is a square. (Points to another square.) This is a square. (Points to another square.) This is a square. (Teacher continues pointing to and naming the remaining examples of squares.)

Testing Sequence: (Points to square example 3.) What is this? *Square.* Yes, square. (Verification.)
(Points to square example 1.) What is this? *Square.* Yes, square.
(Points to square example 5.) What is this? *Square.* Yes, square.
(Points to **circle** example 1.) What is this? *Circle.* Yes, circle.
(Points to **square** example 4.) What is this? *Square.* Yes, square.
(Adds a **new** example of a square to the board and points—test of **generalization**.) What is this? *Square.* Yes, square.
(Points to square example 3.) What is this? *Square.* Yes, square.

(Adapted from Kame'enui & Simmons, 1990, pp. 175-76).

Notice that in this example and in the earlier one on sound/symbol correspondence the teacher used a set of juxtaposed examples to show sameness and difference and to check students' acquisition of this knowledge.

Table 20. Teaching Complex Concept (Democracy) With Frame-Model-Lead-Test/Check-Verification Format

Some concepts can only be understood via other concepts. Pointing to examples does not communicate the logical structure because the defining features are not readily visible (unlike color and shape) or hearable (unlike jazz vs. baroque music) or touchable (unlike soft vs. hard) or tastable (unlike sweet vs. sour). Examples of complex concepts include political systems, orthropods, crime, morality, and marital status. Therefore, we have to teach these concepts via **verbal definitions**, and **then give examples** that enable students to see the defining features.

Framing: We have been studying social formations. Social formations include families, bowling teams, and congregations. Give me another example of a social formation. Jacob? *A classroom.* Yes, a classroom is a social formation. (Verification.) Give me another example of a social formation. Simone. *A political state.* Yes, a political state is a social formation.

Now, you know that social formations have different features. Get ready to list those features. What is one feature? Renee'. *Division of labor.* Excellent. Division of labor. Another. Leslie. *Shared symbols.* Yes, shared symbols. Another. Alfreda. *Distribution of resources.* Marvelous. Distribution of resources—the basis of social class.

Today we will look at another feature—the **form of rule**. Everyone, what feature are we going to look at? *The form of rule.* Yes, the form of **rule**. There are four forms of rule. They are democracy, aristocracy, oligarchy, and party dictatorship. Again, the four forms of rule are democracy, aristocracy, oligarchy, and party dictatorship. Say those four forms of rule with me. Get ready. (Signal.) *Democracy, aristocracy, oligarchy, and party dictatorship.* Yes. Now by yourselves. Get ready. (Signal.) *Democracy, aristocracy, oligarchy, and party dictatorship.* Oh, you are so smart. Let's start with democracy. Here we go.

Model: Everyone, listen to the definition of democracy. Democracy is a social formation in which the people rule. Again, democracy is a social formation in which the people rule.

Lead: Say the definition of democracy with me. Get ready. (Signal.) *Democracy is a social formation in which the people rule.*

Test/Check: All by yourselves. Get ready. (Signal.) *Democracy is a social formation in which the people rule.*

[At this point, students learn the definition of rule and the people via more concepts (such as decision making and enfranchisement) and examples. Using all of these definitions—social formation, democracy, rule, people—the teacher first describes democracies and labels them. For example, ancient Athens, the United States, families where members vote. Then she presents these examples and asks students to name them—as democracies. She follows correct answers with another question--"How do you know?"—so that students must remember and state the definition. *"Because it is a social formation in which the people rule."*

Next, the teacher presents **nonexamples** of democracy—dictatorships, aristocracies, oligarchies—and asks, "Is this a democracy?" The nonexamples might be verbal and written descriptions. The follow up question, again, is "How do you know?" *"Because the people **don't** rule."*

Next the teacher **juxtaposes verbal and written examples and nonexamples** of democracies, asks, "Is this a democracy?" and "How do you know."

Then the teacher gives **entirely new verbal and written examples and nonexamples** so that students can generalize to other democracies and can discriminate between new democracies and nondemocracies.

Throughout, she calls on the whole group and then on individual students.]

Table 21. Teaching Complex Concept (Granite) With Frame-Model-Lead-Test/Check-Verification Format

Granite is another complex concept. Therefore, we have to teach it via **verbal definitions** and **examples** that enable students to see the defining features.

Exercise 1.

Framing: We have been studying igneous rocks. Here's our definition. Igneous rocks form from the crystallization of minerals in magma. Everyone, say that definition of igneous rocks. *Igneous rocks form from the crystallization of minerals in magma.* [Note, the students are advanced enough that the teacher leaves out the lead step.] Yes, igneous rocks form from the crystallization of minerals in magma.

Today we will examine an igneous rock called **granite**. Everybody, if granite is an igneous rock, **what else do you know about it**? Think…. (Signal.) *It forms from the crystallization of minerals in magma.* [Teacher asks students to make a deduction about granite given the definition of igneous rocks.] Excellent deduction!!

Model: Here's the definition of granite. Granite is an igneous rock consisting of the minerals quartz, feldspar, and mica. Again, granite is an igneous rock consisting of the minerals quartz, feldspar, and mica.

Lead: Say it with me. Get ready. (Pause…then signal.) *Granite is an igneous rock consisting of the minerals quartz, feldspar, and mica.* [The teacher probably could have left out the lead.]

Test/Check: By yourselves. (Signal.) *Granite is an igneous rock consisting of the minerals quartz, feldspar, and mica.*

Verification: Excellent saying that definition with so much enthusiasm.

Exercise 2.

Framing: Now, we have already learned the minerals quartz, mica, and feldspar. [Teacher **reviews** the verbal definitions for each one; shows examples of each one; and has students discriminate among examples of these minerals and other minerals. She uses the format, "Is this quartz?…How do you know?…Is this quartz?…How do you know?…Is this feldspar?…How do you know?"] Now I'll show you examples of granite.

Model: [Teacher holds up or shows slides of granite and labels each one as granite.] This is granite…Notice the mica, feldspar, and quartz… This is granite…Notice the mica, feldspar, and quartz… [The examples differ in size, shape, and color of minerals; e.g., pink and grey quartz. But they share the essential and defining features—quartz, mica, and feldspar. Next the teacher juxtaposes examples of granite and nongranite, and labels them.]

This is granite. Notice the mica, feldspar, and quartz….This is **not** granite. Notice that it has **no** quartz…This **is** granite…

Test/Check: [Now the teacher presents examples of granite and nongranite and asks students to discriminate and identify them.] Everyone. Is this granite? *Yes.* How do you know? *There is mica, feldspar, and quartz.* Excellent! Is this granite? *No.* How do you know? *No quartz.* Correct!

Verification: [After each example, above, the teacher verifies and praises accurate answers.]

[Throughout, she calls on the whole group and then on individual students.]

Individual turns…Bart, is this granite?…

The frame-model-lead-test/check-verification format is also used to provide focused and precise instruction on rule relationships and cognitive strategies. Examples are found in Kame'enui and Simmons (1990). We now turn to the fifth feature of scaffolding via lesson design shown on Table 8—selecting, juxtaposing, and sequencing examples.

Scaffolding via selection, juxtaposition, and sequencing of examples. Here is an important rule: "The teacher's examples serve as the heart of the teaching experience" (Kame'enui & Simmons, 1990, p. 109). This is because **the only way we get the logical structures** of verbal associations, concepts, rule relationships, and cognitive strategies **is by comparing and contrasting examples of them**. And the only way to know **if** we have gotten the logical structures correctly is by **applying** to new examples what we think we know, and finding out what happens. Therefore, problems arise when insufficient care is given to examples. For instance,

1. The fractions used during initial instruction in fourth grade have denominators larger than the numerators. 1/3, 1/5, 12/20. At the end of the year many students have trouble adding and subtracting fractions whenever **numerators are larger** than denominators. 5/3, 22/13. Why? Because the teacher accidentally taught a **stipulation error**. The narrow range of examples stipulated that fractions **means** larger denominators. Since knowledge of concepts is induced from examples, students induced a narrow concept of fraction.
2. To teach the concept--granite--a high school teacher uses only examples of granite. He holds up each sample, labels it granite, and shows that it contains feldspar, mica, and quartz. Later, when students see **non**granite rocks that contain one or two of the essential minerals in granite, they erroneously label these granite. Why? Because the teacher **never juxtaposed** (placed next to each other) positive examples (of granite) and nonexamples of granite ("This is granite... This is not granite.") to communicate (reveal) clearly that a rock is granite **only** when all three minerals are present.
3. Middle grades students are defining, identifying, and creating similes. Next the teacher introduces metaphors. Because these two figures of speech differ by one feature ("She **is** a hickory stick." "She is **like** a hickory stick."), the teacher assumes the two concepts can be taught next to each other. Two days later when the teacher asks students to identify metaphors vs. similes, the students are wrong half the time. Why? Because **the concepts**

and examples are so similar that some students never firmly got the **one** difference (like, as) that makes the difference. The teacher should have taught one figure of speech and had students use it many many times until they were absolutely firm, and then taught the other figure of speech a week or more later.

4. A high school algebra teacher ensures that students have mastered the FOIL strategy for multiplying parentheses. (a + b) (c + d) First, outside, inside, last. Then she teaches students new multiplication and factoring strategies—always ensuring mastery before she goes to the next. However, end of grade tests show that many students have not retained skills. Why? The problem is, the teacher did not give **delayed tests** on earlier taught strategies ***after*** **she introduced each new strategy** (for example, multiplying parentheses with exponents)—to make sure the new ones did not **interfere** with retaining the earlier ones. Also, she did not give **distributed practice** on earlier taught strategies (for example, small weekly samples of earlier taught strategies) to keep them strong and to diagnose any weakening skill.

In summary, teachers must carefully plan: (1) the selection of examples; (2) the juxtaposition of examples; (3) the sequencing of examples; and (4) later checks and practice exercises with new and old examples to assess and strengthen students' generalization, discrimination, and retention. Following are guidelines for scaffolding examples. [These are summarized on Table 22.]

Table 22. Guidelines for Using Examples

1. It is impossible teach a concept, rule relationship, or cognitive strategy with one *positive* example because any one thing (example) has many features. Therefore, during initial instruction teachers should use many examples.

2. It is impossible to teach a concept, rule relationship, or cognitive strategy using only *positive* examples. Therefore, during initial instruction the teacher should always juxtapose (that is, present right next to each other or in rapid alternating sequence) *both* positive examples *and* nonexamples.

3. Teach sameness (generalization) during initial instruction systematically and explicitly by juxtaposing (placing next to each other or in rapid alternating sequence) positive examples (of the same thing) that are greatly **different** and indicating that the examples have the **same** label and are to be acted on the same way.

4. Teach difference (discrimination) during initial instruction systematically and explicitly by juxtaposing examples that are ***minimally* different** and treating the examples differently by labeling them and acting on them ***differently***.

5. Select a range of examples that represents the range and composition of the verbal associations, concepts, rule relationships, and cognitive strategies you are trying to teach.

6. It is not a good idea to teach close together different concepts, rules and cognitive strategies that have similar examples. For example, in beginning reading, b and d should be many lessons apart.

7. Immediately after an initial instruction sequence give a brief acquisition, discrimination, and generalization test.

8. Later in the same class period, during the same day, and in future days, the teacher should give delayed retention tests and practice examples.

9. To ensure clarity, eliminate unnecessary words, use words whose meanings are clear, and use the same wording in juxtaposed examples.

1. **It is impossible teach a concept, rule relationship, or cognitive strategy with one *positive* example--an example of the concept, rule, or strategy.** Why? Because any one example has many features. So, if a teacher gives one positive example, students may not figure out which features define the concept, rule, or strategy. Consider the concept triangle. If the teacher points to a triangle on the board and says, "This is a triangle," what exactly are the features that define triangle for students; that is, how do students interpret the communication? That the figure has points? That there are some angles? The color of the drawing? That something is in the middle of the board? Therefore, **during *initial instruction* teachers should use many positive examples** to ensure that students get the logical structure.
2. **It is impossible to teach a concept, rule relationship, or cognitive strategy using *only positive* examples**. This is because: (a) a group of positive examples will have many features; therefore, (b) students will induce (figure out, construct) more than one interpretation, or meaning; and therefore (c) will often be confused and/or wrong. For instance, if students are shown five examples of amphibians (which differ from reptiles in never having a scaly epidermis and not having true clawed feet), they may infer that "amphibian" (in contrast to "reptile") means things with four legs (wrong), or things with stubby noses (wrong), or things that do not have true clawed feet (right), or things with smooth skin (right), or things that are green (wrong), or some combination. Therefore, to ensure that students get the logical structure during initial instruction, the teacher should **juxtapose (that is, present right next to each other or in rapid alternating sequence) *both* positive examples *and* nonexamples.**

   Note: *It is not enough simply to **tell** students the definitions of amphibian and reptile.* [If they repeat it back, it is just a verbal chain.] They must connect the definitions with examples and see how the definitions fit the examples. Following is one way of juxtaposing positive and negative examples.

   "This Leopard Frog **is** an amphibian." [Nonscaly skin; no true claws]
   "This Tiger Salamander is an amphibian." [Nonscaly skin; no true claws]
   "This Spadefoot Toad is an amphibian." [Nonscaly skin; no true claws]
   "This Sand Lizard is **not** an amphibian." [Scaly skin; true claws]

"This Gila Monster is not an amphibian." [Scaly skin; true claws]

"This Chorus Frog **is** an amphibian." [Nonscaly skin; no true claws]

3. **Teach sameness during initial instruction; that is, despite differences in appearance, the examples are to be seen and treated as the same.** It is best to **teach sameness systematically and explicitly** by **juxtaposing** (placing next to each other or in rapid alternating sequence) **positive examples** (of the same thing) that are greatly **different** and indicating that the examples have the **same label** and are to be acted on **the same wa**y. For example, a teacher is communicating that sedimentary rocks often are stratified, or layered. She teaches the concept—stratification—by juxtaposing stratified rocks that differ in many ways, pointing to and labeling the examples. For example,

"This [white, fine-grained limestone] is stratified."

"This [grayish assembly of shell fragments—coquina] is stratified."

"This [orange, fine-grained, weakly cemented sandstone] is stratified."

"This [black, tightly cemented shale] is stratified."

Likewise, a social studies teacher juxtaposes four examples of patriarchal societies (societies in which males rule). However, some societies are industrial and others are agricultural, some are contemporary and others are historical, some are societies in which property descends through males and some are societies in which property descends through females. By comparing and contrasting these differing examples, the essential sameness (male rule) is more clearly seen as the **one sameness that matters in defining societies as patriarchies.**

4. **Teach difference (to make fine discriminations) during initial instruction; that is, despite similarities in appearance, the examples are to be seen and treated as different.** If teachers don't teach difference during initial instruction, students will make errors later when they run into examples that **appear** to be the same as the examples they worked with earlier. For example, beginning readers will think that because b and d both have a vertical line and a curved line, they make the same sound.

It is best to teach difference **systematically and explicitly** during initial instruction **by juxtaposing** examples that are ***minimally* different** and **treating** the examples **differently** by labeling them and acting on them differently. For example, an algebra teacher juxtaposes expressions in which

a. a parenthesis is multiplied by a number vs. not multiplied by a number.
   2 (a + b) vs. (a + b)
b. two parentheses without exponents are multiplied vs. two parentheses with exponents are multiplied.
   $(a + b)(c + d)$ vs. $(a + b)^2 (c + d)$ vs. $(a + b)(c + d)^2$ vs. $(a + b)^2 (c + d)^2$
c. numbers inside the parentheses are added vs. subtracted vs. multiplied.
   (a + b) (c + d) vs. (a + b) (c – d) vs. (a + b) (c x d), etc.
d. parentheses contain positive vs. negative numbers.
   (a + b) (c + d) vs. (a + b) (-c + d), etc.

These systematic side-by-side and sequential comparisons and contrasts enable students clearly to see that small differences make a big difference in the strategy used to solve problems.

5. **Select a range of examples that represents the range and composition of the verbal associations, concepts, rule relationships, and cognitive strategies you are trying to teach.** This means first analyzing the knowledge objectives to see exactly what it means to, for example, know and use the concept democracy, or the strategy for solving equations with one unknown, or that m says "mmm." For example,
   a. There are few kinds of s that students will see. Therefore, to teach that s says "sss," the teacher does not need to use many examples of s.
   b. If you are teaching a simple discrimination (students say "door" when you point to the door and "window" when you point to the window), you need only one example because you are interested in **this particular** door and window. But to teach the **concepts** door and window, you need many examples to show essential and nonessential features. If you show only a few examples, you will accidentally stipulate (wrongly) that the difference between doors and windows is that one is made of glass.
   c. If you are teaching a cognitive strategy for solving equations with one unknown, you must use enough examples that students clearly see the **range of variations** in each element. For example, sometimes the unknown is on the right and sometimes it is on the left side of the equation. Sometimes the unknown is a product, quotient, sum, difference, power, or root of numbers. Sometimes it is labeled x and other times y

and other times by a word ("miles traveled"). Many of the same rules and steps are used but some are different depending on these details.

6. **It is not a good idea to teach close together different concepts, rules and cognitive strategies that have similar examples.** For example, in beginning reading, b and d should be many lessons apart.
7. **Immediately after an initial teaching sequence the teacher should give three quick tests: acquisition test, discrimination test, and generalization test.**
   a. The acquisition test is to see if students got what was just taught. It uses the same examples as during the immediately preceding initial teaching sequence.
   b. The discrimination test is to see if students got the new material well enough that they can discriminate between similar looking, but different, examples. The discrimination test uses materials mastered earlier and material just worked on during the initial teaching sequence.
   c. The generalization test is to see if students got the new material well enough that they can apply their knowledge to examples that look different but are the same. The generalization test uses material already mastered and new material.

Table 23 gives examples of the three tests during a beginning reading lesson.

Table 23. Acquisition, Discrimination, and Generalization Tests Immediately After Initial Teaching Sequence

Initial Teaching Sequence Using Frame-Model-Lead-Test/Check-Verification Format

Framing: (Points to letter m on the board.) We will learn to say the sound for this letter. Everybody look. I'll point to the letter and say the sound.

Model: My turn. (Places finger right below the letter m.) mmmm
Listen again. mmmm.

Lead: Say it with me. (Points to letter m on the board and checks to make sure all are attending.)
Get ready. What sound? *mmmm*
Again. (Pause.) Get ready. What sound? *mmmm.*

Test/check: All by yourselves. (Points to letter.) Get ready. What sound? *mmmm.*
Again. Get ready. What sound? *mmmm.*

Verification: Yes, mmmm.

Acquisition Test

(Teacher calls on different children and the whole group.)
Individual turns. Jackie. Get ready. What sound? (Signals by tapping under the letter.) *mmmm*
Yes, mmm.
Your turn, Emile. Get ready. What sound? (Signals by tapping under the letter.) *mmmm*
Yes, mmm. I love the way you are sitting tall.
Everybody. Get ready. What sound? (Signals by tapping under the letter.) *mmmm*
Yes, mmmm. You learn so fast!

Discrimination Test

(Puts on the board in a random array several examples of letters students have already mastered—t, a, b, r—and several examples of the new letter—m.)

Framing: Now you're going to read the new sound along with some sounds you already know. Everybody. Eyes and ears up here. Sitting tall. Watch my finger.

Test/Check: (Points to the letters in a sequence that puts more and more letters in between each test/check of the new letter—m. This tests and builds retention. For example m, s, m, t, a, m, r, s, b, m, t, a, s, r, m.)
What sound? (Signals by tapping under letter.) *mmm.*
Yes, mmm.
What sound? (Signals by tapping under letter.) *ssss.*
Yes, sss.
What sound? (Signals by tapping under letter.) *mmm.*
Excellent, mmm.
What sound? Signals by tapping under letter.) *t.*
Yes, t.
What sound? (Signals by tapping under letter.) *aaa.*
Yes, aaa.
(And so on through all of the letters on the board several times.)

Generalization Test

(Puts on board or has a large page displaying the letter m in different sizes, colors, and font styles. Uses the same test/check format as with the discrimination test, above.)

[Adapted from Kame'enui, E.J., & Simmons, D.C. (1990). *Designing instructional strategies.* Columbus, OH: Merrill, pp. 139-40, 142.]

The same basic formats would be used for testing acquisition, discrimination, and generalization of concepts, rule relationships, and cognitive strategies.

8. **Later in the same class period (e.g., 10-30 minutes), during the same day, and in future days, the teacher should give delayed retention tests and practice examples.**

   a. Delayed retention tests use the same examples as during initial instruction. Only a few examples are tested at any time. For example, in a first grade class, the teacher periodically points to letters and asks students to say the sounds. Or, in a literature class that began by reviewing the definitions of alliteration and metaphor and then introduced a new figure of speech—simile--the teacher periodically asks students to define each concept and then apply it to the play they are reading. Notice how a set of earlier taught items (x) is reviewed/retention-tested after more and more newer items have been introduced.

      x a x a b x a b c x a b c d x a b c d e x

   b. Practice sessions should be of different lengths, scheduled at varying times, involve different amounts of supervision, and focus on different aspects of what was learned. For example, new algebra strategies should be practiced for a few minutes at the end of the class they were first taught. These same strategies along with previously mastered strategies should be practiced on the same problem sheets to test and foster discrimination and build retention. Later still, students should practice previously mastered strategies with new problems to test and foster generalization.

9. **To ensure clarity, teachers should eliminate unnecessary words, use words whose meanings are clear, and use the same wording on juxtaposed examples.** For example, when reviewing a word list on the board, the teacher should say, "First word. What word? *mammal* Next word. What word? *herbivore*. Next word. What word? *glacial.* Not, “What do you think the next word is?…Okay, and here’s another word. Read this one…” Using the same wording from example to example means students only have to focus on the next word to read; they do not also have to figure out what the teacher is talking about.

Now let's examine the sixth feature of scaffolding via lesson design on Table 8—error correction.

Scaffolding via error correction. It is wise to correct every student error immediately. This does **not** make students dependent on the teacher. In fact, error correction fosters accuracy, speed, building elemental skills into complex wholes, retention, and independence. This is because correcting errors via a familiar format helps students master the material and learn to spot and correct their own errors. Not correcting errors, however, results in small gaps in knowledge that become larger because learners have more and more to catch up on but fewer and fewer skills. This leads to chronic insecurity, disengagement, and inefficiency as it takes more and more time and effort to provide remedial instruction. This is called cumulative dysfluency (Binder, 1996).

Table 24 shows the simplest format for correcting errors.

Table 24. The Simplest Format for Correcting Errors

1. Model. Teacher immediately gives the answer or demonstrates the step. The correction is done in a matter of fact way and is addressed to the whole group. "That word is metamorphosis."

2. Lead. Students say the answer or do the step with the teacher. (Sometimes the lead phase is not needed.)
   "Say it with me. (signal.) *metamorphosis*."
   (The lead is repeated until students are firm.)

3. Test/check. Students are asked the question or are given the problem step again. "What word?" *metamorphosis*

4. Verification. Specific praise from the teacher. "Yes, metamorphosis."

5. Retest/starting over. The teacher backs up in, for example, a sentence, word list, or problem and students do it again. "Start from the beginning of the sentence, please."

   (This is repeated until students are firm. If needed [i.e., continuing errors], there would be re-teaching and/or special remediation for certain students.)

6. Verification. Specific praise. "Excellent. Every word correct!"

Table 25 has examples of error correction.

Table 25. Error Correction Formats

Error Correction With Sound/Symbol Relationship

(Teacher points at the letter a on the board. Students are to say the sound—aaa. One or more children say the wrong sound or do not take their turn.)
Model: (Points to letter a.) aaa
Lead: (Points to the letter a.) Say it with me. Get ready. (Signal) *aaa.*
Test/check: Your turn. Get ready. (Signal) *aaa.*
Verification: Yes, aaa.
Retest: Again. (Points to letter a.) Get ready. (Signal) *aaa.*
Verification: Good saying aaa.

Error Correction With Reading Words

(Teacher points to the words on the board one at a time. Students are to read each word. One or more students make an error [for example, on ramp] or do not take their turn.)
Model: That word is ramp.
Test/check: Everybody, sound it out. (Signal) *r a m p*
What word? (Signal) *ramp*
Retest: Starting over. (Teacher goes back to the first word on the list, points to it and says, "What word?" Teacher makes sure to give individual turns to students who made an error on ramp.)

Error Correction With Identifying Political Forms

(Students have been taught definitions of democracy, monarchy, aristocracy, party dictatorship. They are reading descriptions of political associations. The objective is to use facts in the descriptions to identify the form of political association or to state that information is not sufficient and to suggest what additional information is needed.)

Everybody, read the passage from Suetonius on Augustus…
What form of political association was there under Augustus?...Nick. *Democracy.*
How do you know? *Well, he was elected. It says, "The whole body of citizens…proffered him the title of 'father of his country…'"*
Good so far, Nick. What is the definition of democracy? *Rule by the people.*
What does rule by the people mean?
The people directly or through representatives decide how the society will operate.
Excellent. What decisions did the people make in the excerpt?
They elected Augustus.
Is election by the people the **only** decision meant by rule by the people? *I guess not.*
What other decisions might rule by the people mean?
How to spend money. Making new laws. Going to war.
Excellent. Does Suetonius tell us about these decisions? *No.*
What if Augustus made decisions about expenditures, laws, and war by **himself**? Would that be a democracy, even though the people elected him?
No. It would be a monarchy.
How do you know. *A monarchy is one person ruling.*
Well, do we know about who made these other decisions? *No.*
So, do we know if it was a monarchy or a democracy? *No.*
Correct. We don't know. Read the excerpt again and tell us what information we have and what information we need.
[Note that the teacher's models are less conspicuous in this example, but she still provides a model of how to examine the documents, and she provides immediate tests.]

Now let us examine the seventh and final kind of scaffolding via lesson design shown on Table 8—pre-corrections.

Scaffolding via pre-corrections. Why wait for students to make errors? It is wiser to anticipate difficulties and errors and provide prompts that prevent errors. This will save time and make instruction smoother. If used regularly, students will learn to anticipate difficulties and pre-correct themselves. Table 26 gives examples of pre-corrections.

Table 26. Pre-corrections

1. Everybody, put your finger under the first word on list A. (Check.)
2. Remember to track under the line when you are reading and when someone else is reading. (Check.)
3. I need to see everyone is the ready position. Feet on the floor. Hands in your lap. Eyes on my book…Excellent showing me ready. You are ready to learn!
4. Remember the rule: When demand increases, price increases. Say that rule. (Signal.) *When demand increases, price increases.* Yes, when demand increases, price increases. Look for examples of that rule in the text.
5. When we see an **x** between two numbers or parentheses, we **multiply**. What do we do when we see an **x** between two numbers or parentheses? *Multiply.* Yes, multiply. And when we see a + between two numbers or parentheses, we **add**. What do we do when we see a **+** between two numbers or parentheses? *We add.* Yes, add.

This section examined methods of scaffolding identified on Table 5, page 13. The next section addresses helping students to sustain high engaged time.

IV. Sustaining High Engaged Time

Ellis and Worthington's principle 1 is, "Students learn more when they are actively engaged during an instructional task" (Ellis & Worthington, 1994, p. 15). Active engagement includes **attending** to the teacher and to the instructional activities of other students (e.g., the responses of other students when it is their turn) and **participating** in instruction (e.g., answering questions and solving problems). This section identifies methods for increasing student engaged time. [Please see Table 27.]

Table 27. Increase Students' Engaged Time By

1. **Increasing time allocated to teaching and time engaged in teaching.**
   a. Decrease time on nonteaching topics.
   b. Allocate instructional time to activities in which students have pre-requisite skills and are more likely to be engaged.
   c. Increase time spent teaching.
      (1) Ensure that essential teaching activities are uninterrupted.
      (2) Use pre-planned and field tested curricula.
      (3) Make sure paperwork (e.g., handouts, worksheets, tests, homework to hand in) is laid out for easy distribution.
      (4) Provide initial instruction and periodic practice on students promptly taking their seats and readying themselves for instruction.

2. **Teaching at a Brisk Pace.**

3. **If Possible, Teaching in Small, Homogeneous Groups.**

4. **Establishing a Learning Community.**
   a. Establish and affirm a group mission.
   b. Establish and affirm group rules.
   c. Affirm high expectations at the beginning of lessons, during lessons when students are having difficulty, and especially when they finally get it.
   d. Give frequent, timely, and specific praise.
   e. Frame each next learning task to refocus attention.
   f. Have students sit near each other--all facing the teacher.
   g. Give frequent opportunities for group (choral) and individual responses.
   h. Always ensure mastery of every task before going on to the next.
   i. Keep track of, display, and celebrate progress of individuals and the group.

Increase Time Allocated to Teaching and Time Engaged in Teaching

The more time is available for instruction the more teachers can teach, the more students can be engaged in instruction, and the more they can learn (Stevenson & Stigler,1992). Saving five minutes in one 50 minute class period per day by distributing materials quickly and teaching students promptly to get ready for instruction saves 15 hours (15 class periods) by the end of the year. Saving five minutes every 50 minute class period per day over a full day saves about 25 minutes per day, or 4500 minutes over the school year--time that could be used teaching. Clearly, teachers and schools must

think of ways to remove time wasters and teach more in less time. Time on instruction can be increased in the following ways.

1. **Decrease time on nonteaching topics**, such as discussion of lunch money, bus schedules, future parties, and use of the library. This saved time should be used on direct teaching.
2. **Allocate instructional time to activities in which students are more likely to be engaged.** For example, delay independent reading until students have learned how to read, how to get their books, to start reading quickly, and to sustain reading. Otherwise, the independent reading activity will waste a great deal of time. Likewise, delay cooperative learning activities (or do them in small amounts) until students have skills for taking turns, contributing to discussion, and have sufficient subject matter knowledge.
3. **Increase time spent teaching.** This can be done in several ways.
    a. **Ensure that essential teaching activities** (e.g., reading and math) **become nearly sacred** and are not interrupted by students being pulled out for tests or special lessons, observers coming to watch demonstrations, or parents coming for conferences.
    b. **Use pre-planned and field tested curricula**; e.g., in beginning reading and math, remedial reading, writing, spelling, and even some aspects of science. These curricula allow the teacher to focus more time on teaching because pre-planned curricula: (1) clearly organize lessons into exercises focused on specific knowledge tasks; (2) provide the teacher with examples and the order for presented them; (3) provide the teacher with the questions to ask and problems to give so that students reveal, apply, and practice their knowledge. Appendix 1 lists some pre-planned, field tested curricula.
    c. **Make sure paperwork (e.g., handouts, worksheets, tests, homework to hand in) is laid out for easy distribution**. For example, instead of spending time having students pass in homework, students should routinely place homework in the same spot every day when they enter.
    d. **Provide initial instruction and periodic practice on students promptly taking their seats and readying themselves for instruction.** Specifically,
        (1) Establish an expectation of rapid readiness. "What we have to learn is too important to waste time."
        (2) Define and review the definition of readiness: outside materials are put away, class materials are on the desk, quiet, focus on teacher.

(3) Practice getting ready at the start of the day and beginning new activities; use a timer. "That was faster, but we can do better. Let's do it again."

(4) Provide specific praise for rapid readiness. "That was excellent the way you quieted yourselves so fast. Now we are going to learn."

Teach at a Brisk Pace

Increasing the pace merely four seconds per minute every 50 minute class period yields 12 extra class periods by the end of a 180 day school year. Moreover, Carnine found that when teachers gave 12 learning opportunities (e.g., questions) per minute, students answered correctly about 80 percent of the time, and were on task (engaged) 90 percent of the time. However, when teachers gave five learning opportunities per minute, students answered correctly only 30 percent of the time and were on task only 30 percent of the time (Carnine, 1976). It may be that a quick pace is energizing, holds students' interest, facilitates recall, and leaves little dead space for off-task behavior.

If Possible, Teach in Small, Homogeneous Groups

Small, homogeneous groups (especially during initial instruction in reading, spelling, language, and math) allow instruction to move faster (e.g., there are fewer errors to correct, fewer students to call on), give students more opportunity to respond, and permit closer and more frequent monitoring and timely error correction. These groups can be created with pre-tests made by the teacher or by placement tests that come with commercial curricula (see Appendix 1). Homogeneous groups (which may be created across classes or even across grades in some curricula--such as beginning reading) should be seen as fluid. Teachers should note children who are moving quickly, and re-place them in faster moving groups. Well managed homogeneous groups do not produce tracks that perpetuate and solidify differences among children. On the contrary, **small homogeneous groups allow students' individual (but shared) needs and preferences to be met** (Grossen, 1996), which increases the chances of high engagement and achievement, and enables students to move as fast as they can.

Establish a Learning Community

A whole class or a small group in a class (e.g., a remedial reading group) becomes a learning community when

1. There are shared goals. "We will learn all of this."
2. There are shared guiding principles. "When you work hard, you get it."
3. Shared moral principles. "We encourage each other. We do not make fun if a person makes mistakes."
4. Shared definitions of a hardworking member; e.g., takes turns, answers, tries hard.
5. Members achieve individually and as a group.
6. Members look forward to lessons, are enthusiastic during lessons, and value their accomplishments.
7. Part of each member's identity concerns learning in and contributing to the learning of other members and the group as a whole.

In brief, a learning community--much as a close knit basketball team--gives its members energy, focuses their attention on the common task, helps them to increase their effort, and weakens any incentive they might otherwise have had for egoistic , off-task, or disruptive behavior.

Following are methods for fostering and sustaining a learning community. Imagine students in middle school who read at the 4th grade level and have just been placed in a small remedial reading group.

1. **Establish and affirm a group mission**. "You all know that you have a tough time reading. It 's not your fault. You have tried hard for years, and reading just does not get any easier. Maybe you are discouraged. Maybe you think you can't do it. Well, you are now in a great program. This program works. And you **will** learn to read. We are **all** going to learn how to read--and to read with skill! " Remind students of this mission periodically--especially when they are having difficulty and when they are making important gains.
2. **Establish and affirm group rules.** "Try hard. Take your turn. No bothering your neighbor. Sit big. Follow directions. " Stress that rules help students learn-- give them their best chance. Post rules in a prominent place and personalize them--perhaps with a group name. Periodically, have students repeat the rules ("What makes us a great

team?"...) and remind students of the rules as needed. "I need to see everyone sitting big ready to learn.... Excellent."

3. **Affirm high expectations at the beginning of lessons, during lessons when students are having difficulty, and especially when they finally get it.**
   "Sam is trying hard. He's going to get it. When you work hard, you get it. You always get it."
   "There you go! Sam got it. He worked hard and he got it."
4. **Give frequent, timely and specific praise.** "Excellent the way you sounded out that word." "I love the way you are all sitting big. You make me proud." "Excellent Juan for helping Jerry!"
5. **Frame each next learning task to refocus attention.** "Next task. Reading words the fast way. Here we go."
6. **Have students sit near each other--all facing the teacher.** The teacher should maintain close proximity so that she can monitor students and correct errors. If students are at desks and are more spread out, the teacher should move among the students, giving specific praise. "Excellent the way you are tracking under the words."
7. **Give frequent opportunities for group (choral) responses.** "Everyone. First word (on the list)... What word?..." This sustains the group feel and gives students hard evidence of group mastery. Also, of course, call on individual students.
8. **Ensure mastery of very task** (every word to spell, every word list to read without errors, every line of a story, every comprehension question about a passage) **before going to the next**. Mastery becomes an expectation. "We do it until we get it perfectly. " It also becomes a source of pride. "We always get it perfectly."
9. **Keep track of, display, and celebrate progress of individuals and of the group.** Examples include the number of lessons mastered, curriculum based mastery tests passed, completed assignments, books read. The teacher might have a bar graph showing the number of completed assignments handed in. When the bar reaches a target, there is a popcorn party.

This section focused on methods for increasing students' engaged time. The next section addresses helping students to organize and activate knowledge.

V. Helping Students to Organize and Activate Knowledge

Ellis and Worthington's principle 7 is, "Learning is increased when teaching is presented in a manner that assists students in organizing, storing, and retrieving knowledge" (Ellis & Worthington, 1994, p. 38). Their review identifies two main reasons for students' difficulty organizing, storing, and retrieving knowledge (Ellis & Worthington, 1994, p. 38), as shown on Table 28.

Table 28. Reasons For Students' Difficulty Organizing, Storing, And Retrieving Knowledge

1. **Students have difficulty accessing knowledge.** For example, students have difficulty understanding advanced readings or answering questions about the American Revolution. This may be because
   a. **They lack a sufficient knowledge base to begin with.** They never mastered the names and roles of Madison, Jefferson, Hamilton, and others--**simple facts**. They never mastered the sequence of events leading to the war—**a verbal chain**. They never mastered a set of **concepts**--such as Tory, despotism, taxation, The People. They never mastered the difference between a confederation of states and a federal system—**verbal discrimination**. They never mastered **rule relationships**--such as, "Perceived exploitation fosters communication that increases the cohesion of an exploited group." They never mastered a **model** of social conflict that could organize old and new knowledge into a meaningful whole. And they never mastered a **cognitive strategy** for analyzing events and documents that would integrate and make meaningful both older and newer knowledge.
   b. **Whatever knowledge they have is poorly organized**; they do not have strong verbal associations; definitions of concepts; big ideas, rule relationships, and models to make sense of events; and cognitive strategies for examining and applying what they do know.
   c. **They do not know what knowledge is relevant so that it may be retrieved.** For example, they do not know that the difference between Federalists and anti-Federalists helps to explain difficulties and compromises in writing and ratifying the Constitution. Therefore, they cannot call on whatever they remember of Hamilton, Franklin, and Patrick Henry to discuss the Constitution.
2. **Students have difficulty transferring knowledge.** Specifically they have difficulty: (a) applying earlier knowledge to present knowledge (for example, seeing that a new example is part of the same concept as an earlier learned example); and (b) applying earlier knowledge from one task to a different but relevant new task (for example, applying knowledge of how to take the square root of numbers in the context of more complex algebra problems). This may be because:
   a. Their earlier knowledge **is too bound** to the examples and problems by which it was taught—cognitive rigidity.
   b. They do not know the **cues** in new material that suggest the relevance of earlier learned material.

There are two general ways to remedy or prevent these difficulties: sufficient scaffolding and special methods to aid organizing, storing, and retrieving knowledge. These are listed on Table 29.

Table 29. Methods for Helping Students Organize, Store, and Retrieve Knowledge

1. Sufficient scaffolding, including:
   a. Big ideas that help students connect new and earlier learning.
   b. Using a wide range of examples. Teaching sameness and difference.
   c. Continual strategic integration.

2. Special Methods
   a. Visual devices, including:
      (1) Lesson outlines displayed.
      (2) Guided notes.
      (3) Concept and Proposition Maps.

   b. Focused instruction

Sufficient Scaffolding

Virtually all of the methods discussed earlier on scaffolding can facilitate students organizing, storing, and retrieving knowledge, as shown on Table 30.

Table 30. How Scaffolding Will Facilitate Students' Organizing, Storing, and Retrieving Knowledge

1. Proper scaffolding helps to ensure that students have a sufficient knowledge base.
2. Big ideas—central concepts, rule relationships, theories and models—provide frameworks that help students connect new and earlier learning.
3. Using a wide range of examples, and teaching students properly to discriminate among and generalize to new examples facilitates transfer in the future—especially by teaching students the relevant cues (samenesses).
4. Continually strategically integrating elemental knowledge into larger wholes helps make activities and skills meaningful—and therefore more easily retained and retrieved.
5. In light of number 4, teaching cognitive strategies (e.g., for analyzing historical documents) facilitates students making sense of future materials.

Special Methods to Aid Organizing, Storing, and Retrieving Knowledge

There are several methods for helping students organize, store, and retrieve knowledge: visual devices and focused instruction.

Visual devices. Visual devices include displayed lesson outlines, guided note formats, and concept/proposition maps.

1. **Lesson outlines displayed on the board are an easy way to help students organize knowledge.** The teacher simply writes across the top of the board the main exercises in the class period and important verbal associations, concepts, or rule relationships that will be worked on. For example:

Figure 3. Example of Displayed Outline of Lesson

Exercise 1.	**Exercise 2.**	**Exercise 3.**	**Exercise 4.**
Review concept map on conflict. Review concepts: federal government vs. confederation	New vocabulary: Federalists, Anti-Federalists Historical context: social classes and different economic interests	Read excerpts of Federalist Papers and complementary Anti-Federalist writings/speeches. Summarize arguments: main concepts and rule relationships.	Class discussion summarizing main arguments of Federalists and Anti-Federalists. Students suggest possible compromises--foreshadowing Bill of Rights.

The visual outline enables students to see the logical progression of learning in the lesson and why it is important to pay attention and remember what was learned. The outline also helps to sustain engagement by showing students how much is left--so they do not feel that a tough lesson is endless.

2. **Guided note formats are another way to help students organize and retrieve knowledge.** Students are provided with sheets of paper already divided into sections outlining the lesson. Students take notes in the relevant spaces during lecture, demonstration, reading, and question-answer portions of the class period. Figure 4 shows part of guided notes for a lesson.

Figure 4. Guided Note Format

Rule relationship: The problem of size (and coordination) and economic interests yields two positions:

Strong central government.

More freedom of a nation's units (states and individuals).

These positions are represented by two groups: Federalists and Anti-Federalists.

Federalists

Anti-Federalists

The Constitution as a Focal Point for the Decision.

The Convention:

When

Where

Who participated

Processes: conflict, compromise

Ratification by states

Federalist arguments

Hamilton

Madison

Anti-Federalist arguments

Smith

Henry

3. **Concept/proposition maps are another method for helping students organize, access, and retrieve knowledge.** (Note, proposition means rule relationship.) These maps (on paper) can be given to students before instruction on a topic. They can also be displayed on power points slides, transparencies, and drawings. The point is that they all depict connections among concepts. Examples include:

   a. **Typologies.** These could be lists of classes and subclasses of rocks, political systems, trees, mammals.

   b. **Theories or models of causal or temporal relationships**. Figure 1, on page 28, is an example of a concept map (serving as a big idea) that shows connections among

concepts or classes of events. Other concept maps might depict stages in life cycles, historical connections among different literature types, and physical processes, such as convection cells (Grossen, Carnine, Romance, & Vitale, 1998; Romance & Vitale, 2001).

Students and teachers can create concept/proposition maps together as a course progresses. Romance & Vitale suggest that "Building a concept (map. MK) showing students' prior knowledge both clarifies what their prior knowledge is (e.g., concept connections) and illustrates how concept maps represent conceptual knowledge" (Romance & Vitale, 2001, p. 401). Romance and Vitale (2001) present the following steps for teachers and students preparing concept maps.

The teacher develops a list of important concepts for the unit or lesson.

The teacher initiates the activity by introducing key concepts. These might be put on post-it notes.

The teacher reviews prior knowledge with students to elicit ideas and key questions about concepts to include or about their arrangement on the map.

Students offer suggestions with respect to concepts to add or delete, concept connections (rule relationships), and arrows representing connections.

The teacher edits the concept map based on student inputs; e.g., adds or deletes concepts, rearranges linkages.

Focused Instruction. In addition to visual devices (above) for helping students organize, access, and retrieve knowledge, these skills (e.g., careful listening and note taking, identifying concepts and rule relationships, remembering) can be taught in a direct, focused fashion. Early in the school year, students receive daily instruction on these skills in short lessons; e.g., how to take notes, follow directions, organize papers, comprehend different kinds of written material. Skills learned during focused, initial instruction are then applied to more academic tasks; e.g., taking notes on current readings.

There are commercial, field tested curricula for teaching these skills in elementary and secondary grades. S*kills for school success*, developed by Anita Archer and Mary Gleason and published by Curriculum Associates, teaches elementary and high school students skills relevant to the principles of sufficient scaffolding, organizing and

activating knowledge, and high engaged time. Moving from highly scaffolded to less scaffolded instruction, the programs for grades 3 through 6 focus on: (1) school behaviors and organizational skills (e.g., organizing and using notebooks; using a calendar to plan, do, and complete homework; and organizing papers); (2) learning strategies for gaining information and responding in class (e.g., answering chapter questions, reading expository chapters, taking notes on lectures and written material); (3) strategies for studying and for taking tests; (4) using textbook reference skills (e.g., using the table of contents, glossary, and index); (5) reading and interpreting graphics; and (6) using reference books.

Many of the same skills are taught in Archer and Gleason's high school programs, *Advanced skills for school success.* Tables 31-34 list objectives in each program, which comes with a teacher guide that provides precise formats for how to teach, and student books with material for students to apply skills. Modules 3 and 4 are most relevant to the principles of scaffolding instruction and teaching students to access and organize knowledge.

Table 31. Advanced Skills for School Success
Module 3
Effective Reading of Textbooks

Lesson 1: Students will apply a **preview strategy** to determine the organization and content of a chapter or a section of a chapter in a content-area textbook.
Lesson 2: After reading a paragraph, students will **select a top**ic that specifically states what the whole paragraph is about.
Lesson 3: After reading a paragraph, students will **identify the topic** and the important details.
Lesson 4: After reading a paragraph, students will **recite the topic** and important details in their own words.
Lesson 5: After reading the paragraph, students will recite the topic and the important details in their own words.
Lesson 6: Students will apply the ACTIVE READING strategy to factual material.
Lesson 7: Students will **take not**es on a chapter or other expository material. Their notes will be well organized and will include a topic for each paragraph and important details.
Lesson 8: Students will take well-organized notes on a chapter or other expository material. Their notes will include a topic for each paragraph and important details. Students will retell the chapter content using their notes.
Lesson 9: Students will take notes on a textbook chapter on other expository material. Their notes will be well organized and will include a topic for each paragraph and critical details. Students will retell the chapter content using their notes.
Lesson 10: Students will take well-organized notes on a textbook chapter or other expository material. Students will write study questions that parallel the content of their notes.
Lesson 11: Students will take well-organized notes on a textbook chapter or other expository material. Their notes will include a topic for each paragraph and important details. Students will write study questions that parallel their notes.
Lesson 12: Students will complete a **map of written** material by adding and supporting details.
Lesson 13: Students will complete a map of written material by adding topics and details to the heading and subheadings.
Lesson 14: Students will map the content of a section of a chapter, organizing headings, subheadings, topics, and details.
Lesson 15: Students will map the content of written material, organizing headings, subheading, topics, and details.
Lesson 16: Students will learn the characteristics of a **paragraph summary** and will evaluate summaries of expository material.
Lesson 17: Students will learn the five steps in the POWER strategy (prepare, organize, write, edit, rewrite) and how to apply the strategy to writing a summary.
Lesson 18: Using notes with important information checked, students will develop a map of the information and write a summary paragraph.
Lesson 19: Students will take indentation notes on an article.
Lesson 20: Students will write a summary paragraph from notes they have taken.
Archer, A., & Gleason, M. (1993). *Advanced skills for school success. Module 3. Effective reading of textbooks.* Billerica, MA: Curriculum Associates.

Table 32. Advanced Skills for School Success
Module 4
Learning from Verbal Presentations and Participating in Discussions

Lesson 1: Students will **determine topics** and important details presented in a lecture.
Lesson 2: The student will **record topics** and important details in a lecture.
Lesson 3: Students will record important topics, details, and diagrams presented during a lecture. Students will reread and revise lecture notes soon after the presentation to ensure understanding.
Lesson 4: Students will record important topics, and diagrams presented during a lecture. Students will reread and revise lecture notes soon after the presentation to ensure understanding. Students will add study questions to the left of their notes.
Lesson 5: Students will record important topics, details, and diagrams presented during a lecture. Students will **reread and revise their notes** soon after the presentation to ensure understanding. Students will write study questions in the margin and will use these questions to study their notes.
Lesson 6: Students will generate ideas with a partner. Students will exhibit cooperative behaviors as they brainstorm with their partner.
Lesson 7: Students will **generate ideas** with a partner. Students will exhibit cooperative behaviors as they brainstorm with their partner. Students will evaluate their brainstorming behaviors.
Lesson 8: Students will generate ideas with team members. Students will exhibit cooperative behaviors as they brainstorm with their team members. Students will evaluate their brainstorming behaviors.
Lesson 9: Students will generate ideas with their partner. Students will exhibit cooperative behaviors as they brainstorm with their partner. Students will evaluate their brainstorming behaviors.
Lesson 10: Students will understand the **steps for participation** in a discussion. Students will generate examples for each of the strategy steps.
Lesson 11: Students will use the **discussion strategy** to prepare for and participate in a discussion. Students will exhibit cooperative behaviors during a discussion. Students will evaluate their discussion behaviors.
Lesson 12: Students will use the discussion steps to prepare for and participate in a discussion. Students will exhibit cooperative behaviors during a discussion. Students will evaluate their discussion behaviors.
Archer, A., & Gleason, M. (1994). *Advanced skills for school success. Module 4 . Learning from verbal presentations and participating in discussion.* Billerica, MA: Curriculum Associates

Modules 1 and 2 are perhaps most relevant to scaffolding and to sustaining high engaged time—for, without the skills in these two modules students are likely to be inattentive and to participate ineffectively and inefficiently, requiring teachers to spend a lot of time correcting misbehavior and reminding students to pay attention.

Table 33. Advanced Skills for School Success
Module 1
School Behaviors and Organization Skills

Lesson 1: Students will learn school behaviors that should be exhibited before class
Lesson 2: Students will learn school behaviors that should be exhibited during class. They will also learn why these school behaviors are important to their teachers, to their peers, and to themselves.
Lesson 3: Students will organize a **notebook** and will recognize the benefits of using a notebook.
Lesson 4: Students will write concise **calendar** entries that include the subject and a notation about the assignment.
Lesson 5: Students will write calendar entries that include the subject and assignment. Students will write calendar entries on the correct due date.
Lesson 6: Students will understand the need for individual calendars and class calendars. Students will organize individual calendars for immediate use.
Lesson 7: Students will divide long-term assignments into smaller tasks, determine due dates for each task, and record these tasks on an assignment calendar.
Lesson 8: Students will divide long-term assignments into smaller tasks and determine due dates for each task. Students will write calendar entries on the correct due date. Entries include the subject, the assignment, and the task. Students will use calendar entries to determine homework assignments that should be completed.
Lesson 9: Students will use an assignment calendar to plan homework and formulate an action list.
Lesson 10: Students will select an appropriate time and place for **home study**. Students will determine the materials they should keep in their study area.
Lesson 11: Students will describe procedures for completing their homework.
Lesson 12: Students will demonstrate knowledge of school behaviors and organization skills.
Archer, A., & Gleason, M. (1992). *Advanced skills for school success. Module 1. School behaviors and organizational skills.* Billerica, MA: Curriculum Associates

Table 34. Advanced Skills for School Success
Module 2
Completing Daily Assignments

Lesson 1: Students will complete neat, well- organized, legible papers.
Lesson 2: Students will complete neat, well-organized, legible papers.
Lesson 3: Students will **use four steps in planning how to complete their assignments.**
Lesson 4: Students will use four steps in planning how to complete complex assignments, such as science experiments and cooperative projects.
Lesson 5: Students will use four steps in planning how to complete their assignments.
Lesson 6: Students will be able to change a question into part of the answer.
Lesson 7: Students will be able to change a question into part of the answer.
Lesson 8: When answering questions, students will write accurate, complete-sentence answers that restate the question.
Lesson 9: Students will write correct, complete-sentence answers that restate the question.
Lesson 10: Students will detect and correct sense errors (extra, omitted, or inappropriate words) in an assignment.
Lesson 11: Students will proofread assignments to ensure that the sentences make sense and have correct capitalization and punctuation.
Lesson 12: Students will detect and correct spelling errors in assignments and other writing products.
Lesson 13: Students will proofread assignments and other written products to ensure that the sentences make sense and have correct punctuation, capitalization, and spelling.
Lesson 14: Students will use the HOW strategy to complete an assignment; they will write complete-sentence answers; and they will proofread and correct any errors in the answers.
Lesson 15: Students will **use the READ, COVER, RECITE, CHECK strategy to study** a set of words and definitions.
Lesson 16: Students will use READ, COVER, RECITE, CHECK to study a study guide. After they recite, they will take notes on the important information.

Archer, A., & Gleason, M. (1993). *Advanced skills for school success. Module 2. Completing daily assignments.* Billerica, MA: Curriculum Associates

Summary

This paper presented a model of logically progressive instruction as a framework for applying the principles in Ellis and Worthington's document. The paper then focused on three principles--providing sufficient scaffolding, sustaining high engaged time, and helping students to organize and activate knowledge--and described instructional methods relevant to each principle. Following sections include Appendix 1 (a list of field tested strand based curricula), Appendix 2 (for assessing teachers' knowledge of the methods presented in this document), and a bibliography.

Appendix 1
Some Strand Based, Field-Tested Curricula

Language for Learning is for grades pre-K-2. This curriculum teaches children the concepts, language rules, forms of communication, and classroom skills needed for oral and written expression, and for participation in school activities. It can be used as part of a regular pre-school or kindergarten curriculum; to give a head start to children developmentally delayed or at-risk; or for children in first or second grade who have not yet acquired essential language and social skills.

The curriculum comprises 150 lessons organized into six groups of skills: Actions, Description of Objects, Information and Background Knowledge, Instructional Words and Problem-Solving Concepts, Classification, and Problem-Solving Strategies and Applications. The content of each of the six groups, with the exception of Classification, is divided into strands, or tracks. These tracks continue across the lessons and are taught in a carefully arranged sequence of exercises. Students apply what they have learned in earlier tracks to the exercises in later tracks. Each daily lesson contains exercises from several tracks. [Engelmann, S., & Osborn, J. Columbus, OH: SRA/McGraw-Hill.]

Reading Mastery is a complete basal program, integrating decoding and comprehension, for students in grades pre-k or k-6. Complex skills are taught in sequences of sub-skills learned to 100% mastery. Lessons (taught in small groups) involve brisk pace, a high rate of student opportunities to respond, group and individual turns, and immediate error correction to prevent students developing gaps in knowledge. Student books contain fiction (classical and modern), history, poetry, geography, meteorology, and oceanography. Generally, students complete six years of reading instruction in five years. [Engelmann, S., *et. Al.* Columbus, OH: SRA/McGraw-Hill.]

Horizons. This curriculum is for students in grades K- 4. *Horizons* uses many of the proven techniques of Direct Instruction, updated with current research on beginning reading. Levels A,B, and Fast Track A-B build a solid foundation for fluency and comprehension by systematically teaching phonemic awareness and phonics. Fast Tracks C-D expands key decoding and vocabulary skills while developing higher level thinking and comprehension strategies. Together, Fast Tracks A-B and C-D provide average and above-average students with about four years of reading instruction in just two school years. [Engelmann, S., Engelmann, O., & Davis, K.L.S. Columbus, OH: SRA/McGraw-Hill.]

Journeys. This curriculum is for students in grades K-3. *Journeys* is based on content found in Direct Instruction programs previously published by SRA. Children will be able to decode simple, regularly spelled words and read stories composed of those words in the kindergarten level. In the first level, children read stories that require increasingly sophisticated comprehension, such as examining different viewpoints and analyzing the motives of characters. In the second level, students read at a near conversational rate with accuracy and comprehension. Finally, in the third level, children have solid decoding skills, a relatively large reading vocabulary, and a good

working knowledge of word meanings. [Engelmann, S., Engelmann, O., & Hanner, S. Columbus, OH: SRA/McGraw-Hill.]

Corrective Reading. This curriculum is for students in grades 4-12 who have not learned to read proficiently in other programs and do not learn well on their own. The curriculum allows students to work in a comprehension strand, a decoding strand, or both. Each of these strands has four levels. The Decoding strand progresses from teaching letter sounds and blending skills to reading expository passages characteristic of textbook material. The Comprehension strand helps develop reasoning strategies used by successful readers; e.g., applying prior knowledge, making inferences, and analyzing evidence. Both strands include teacher presentation books, teacher guides, student books, and workbooks. Ongoing assessment is built into the program to provide immediate feedback. *Corrective Reading* is also an excellent program for children with learning disabilities. [Engelmann, S, Carnine, L., Johnson, G., Hanner, S., Osborn, S., & Haddox, P. (1998). *Corrective Reading: Decoding* and *Corrective Reading: Comprehension.* Columbus, OH: SRA/McGraw-Hill.]

Rewards: Reading Excellence, Word Attack, and Rate Development Strategies. This program teaches multi-syllabic decoding strategies and vocabulary to mastery in a short time (20 lessons). It also contains correlated literature in history and science to foster fluency and generalization. It is an excellent program for use in class, after school, or in summer programs. [Archer, A., Gleason, M, & Vachon, V. (2000). *REWARDS.* Longmont, CO: Sopriswest.]

Connecting Math Concepts. This curriculum is geared toward the K-8th grades. Lessons are organized into paths, with each lesson divided into five- to ten-minute segments that address several topics. Students move forward in small steps, knowing that what they learn has utility because they will use it again and again. [Engelmann, S., Carnine, D., Engelmann, O., & Kelly, B. Columbus, OH: SRA/McGraw-Hill.]

Corrective Mathematics. This curriculum contains placement tests that identify students' needs precisely, and then materials for instruction on basic operations, fractions, decimals, percents, and equations. [Engelmann, S. & Steely, D. (1997). *Corrective mathematics*. Columbus, OH: SRA/McGraw-Hill.]

Designing effective mathematics instruction. This book provides precise formats for teaching virtually everything in an elementary or special education math program—from counting to geometry. [Stein, M., Silbert, J., & Carnine, D. (1997). *Designing effective mathematics instruction.* Upper Saddle River, NJ: Merrill.]

Skills for School Success. This set of modules teaches students (grades 3-6): school behaviors and organizational skills (e.g., organizing and using notebooks; using a calendar to plan, do, and complete homework; and organizing papers); (2) learning strategies for gaining information and responding in class (e.g., answering chapter questions, reading expository chapters, taking notes on lectures and written material); (3) strategies for studying and for taking tests; (4) using textbook reference skills (e.g., using

the table of contents, glossary, and index); (5) reading and interpreting graphics; and (6) using reference books. [Archer, A., & Gleason, M. *Skills for school success.* Billerica, MA: Curriculum Associates. www.curriculumassociates.com.]

Understanding U.S. History I and II. This program teaches students a general strategy for analyzing historical events, processes, and periods—Problem-Solution-Effect. The strategy is then applied to U.S. history using original materials. The program contains concept maps and interspersed questions (to foster higher-order thinking) and a variety of writing projects. [Carnine, D., Crawford, D., Harniss, M, & Hollenbeck, K. (1994). *Understanding U.S. History, Volumes I and II.* Eugene, OR: Considerate Publishing.]

Expressive Writing. This middle school and high school curriculum teaches the elements of composing and writing (punctuation, sentence and paragraph construction, quotations, editing), and for writing and editing in different formats. [Engelmann, S., & Silbert, J. (1983). *Expressive writing*. Columbus, OH: SRA/McGraw-Hill.]

Reasoning and Writing. This curriculum introduces higher-order thinking skills at the earliest levels and uses them throughout a well-integrated program to teach effective communication. The curriculum is for students in grade levels K-8. The curriculum features lessons built around stories and writing projects. [Engelmann, S., Arbogast, A.B., Davis, K.L.S., Grossen, B., & Silbert, J. Columbus, OH: SRA/McGraw-Hill.]

Basic writing. This middle and high school curriculum teaches elemental rules for composing sentences and paragraphs, and more advanced strategies for writing papers. [Gleason, M. & Stults, C. (1983). Columbus, OH: SRA/McGraw-Hill.]

Advanced Skills for School Success. There are four modules in this curriculum for high school. [Archer, A., & Gleason, M. (1992). *Advanced skills for school success. Module 1. School behaviors and organizational skills.* Billerica, MA: Curriculum Associates. Archer, A., & Gleason, M. (1993). *Advanced skills for school success. Module 2. Completing daily assignments.* Billerica, MA: Curriculum Associates. Archer, A., & Gleason, M. (1993). *Advanced skills for school success. Module 3. Effective reading of textbooks.* Billerica, MA: Curriculum Associates.
Archer, A., & Gleason, M. (1994). *Advanced skills for school success. Module 4 . Learning from verbal presentations and participating in discussion.* Billerica, MA: Curriculum Associates.]

A Mathematics Series, on videodisc, for teaching geometry, equations, roots, exponents, graphs, and statistics. [St. Ann, MO: BFA Education Media, 1991.]

Understanding Chemistry and Energy. This videodisc program focuses on atomic and molecular structure, energy forms, organic compounds, energy activation and catalysis. [St. Ann, MO: BFA Educational Media, 1991.]

Earth Science. This videodisc program explores phases of matter, density and mass, and geologic processes. [St. Ann, MO: BFA Education Associates, 1991.]

Spelling Mastery. This curriculum is for students in grades 1-6. It incorporates instruction from the phonemic, morphemic, and whole-word approaches. [Dixon, R., Engelmann, S., Bauer, M., Steely, & Wells, T. Columbus, OH: SRA-McGraw-Hill.]

Spelling Through Morphographs. This remedial program teaches a variety of morphographs (e.g., prefixes, suffixes, and word bases) and rules for combining them into general strategies for students to use with thousands of words—familiar and unfamiliar. [Dixon, R., & Engelmann, S. (1979). *Corrective spelling through morphographs.* Columbus, OH: SRA/McGraw-Hill.]

Appendix 2.
Guidelines for Assessing Teachers' Knowledge Providing Sufficient Scaffolding, Helping Students Organize and Activate Knowledge, and Sustaining High Engaged Time

1. The teacher can list the four main forms of knowledge and give examples of each kind.

2. The teacher can define each of the forms of knowledge in terms of its logical structure.

3. The teacher can show how each higher form of knowledge contains, as elements, the lower forms of knowledge.

4. The teacher can list and describe the six ways learners' skills can change as a function of effective instruction. The teacher can give examples of each kind of change.

5. The teacher can give examples of the difference between knowing (getting the logical structure) and using (applying, generalizing) each of the four forms of knowledge.

6. The teacher can give a rationale and examples for why instruction is more likely to be effective when students are first taught a form of knowledge and then are taught how to generalize, use, or apply it; and why it is often less effective to try to teach forms of knowledge at the same time (or in the context of) teaching students to generalize, use, or apply that knowledge.

7. The teacher can state the general differences (objectives, teaching methods, evaluation) between initial and expanded instruction.

8. The teacher can give examples of initial vs. expanded instruction for verbal associations, concepts, rule relationships, and cognitive strategies in a content area.

9. The teacher can state the ways scaffolding facilitates acquiring and using knowledge.

10. The teacher can state the main features of scaffolding.

11. The teacher can state how the logical structure of a curriculum serves as a scaffold.

12. The teacher can describe the main organizational features of strand based curricula.

13. The teacher can state the advantages of strand based curricula as scaffolds.

14. The teacher can examine a knowledge system (e.g., elementary mathematics or secondary English composition) and identify the main strands; and can then arrange specific tasks (verbal associations, concepts, rule relationships, and cognitive strategies) to be taught along each strand using principles of strand progression.

15. The teacher can create lessons consisting of short exercises. Each exercise consists of task items drawn from different strands.

16. The teacher can assess the adequacy of strand based lessons considering: (a) the extent to which tasks from earlier lessons are reviewed and applied in a lesson; (b) exercises within the lesson mutually support one another; (c) skills worked on in the lesson are relevant to (prerequisites for, are embedded in) next lessons.

17. The teacher can define strategic integration and state its purpose and benefits.

18. The teacher can create examples of strategic integration across lessons.

19. The teacher can create examples of strategic integration across exercises within lessons

20. The teacher can define big ideas and state how they are important as scaffolds.

21. The teacher can give examples of big ideas—central concepts, rule relationships or propositions, and theories or models--drawn from (a) a state course of study, (b) research, and (c) his or her own analysis of a knowledge system.

22. The teacher can state how big ideas might be communicated to students—e.g., verbally, concept maps—and how they would serve as scaffolds during initial instruction and during application across many lessons.

23. The teacher can state how the logical structuring of a lesson can serve as a scaffold.

24. The teacher can state the main features of deductive and inductive arguments.

25. The teacher can give examples of lessons organized as deductive and inductive arguments to scaffold instruction.

26. The teacher can give examples of how to foster strategic integration by logically organizing exercises within a lesson.

27. The teacher can state the main steps in the Socratic form of instruction and what skills this form teaches.

28. The teacher can identify learning tasks for which the Socratic format would be useful.

29. The teacher demonstrates skill at using the Socratic format.

30. The teacher can give examples of each phase of the model-lead-test/check-verification format of instruction.

31. The teacher can state the reasons why the model-lead-test/check-verification format of instruction is effective.

32. The teacher can prepare instructional sequences using the model-lead-test/check-verification format for verbal associations, concepts, rule relationships, and cognitive strategies.

33. The teacher can state why it is not possible to teach a concept, rule relationship, or cognitive strategy with one *positive* example.

34. The teacher can define stipulation error.

35. The teacher can create examples of stipulation errors taught by using too narrow a range of examples.

36. The teacher can state principles for deciding which examples and how wide a range of examples to use.

37. The teacher can create a range of examples that is adequate for initial instruction of a concept, rule relationship, and cognitive strategy.

38. The teacher can state why it is not possible to teach a concept, rule relationship, or cognitive strategy using **only** *positive* examples.

39. The teacher can state the design principles for juxtaposing positive and negative examples to teach sameness.

40. The teacher can create a set of juxtaposed examples for teaching sameness in a concept.

41. The teacher can state the design principles for juxtaposing positive and negative examples to teach difference.

42. The teacher can create a set of juxtaposed examples for teaching difference in a concept.

43. The teacher can state why it is not a good idea to teach close together different concepts, rules and cognitive strategies that have similar examples.

44. The teacher can give examples of sequencing too closely tasks that are too similar, and can give examples of proper sequencing of tasks that are similar.

45. The teacher can define acquisition, discrimination, and generalization tests.

46. The teacher can state the importance and the purpose of giving brief acquisition, discrimination, and generalization tests after initial instruction.

47. The teacher can create examples of brief acquisition, discrimination, and generalization tests after initial instruction on a concept, rule relationship, and cognitive strategy.

48. The teacher can define delayed retention tests.

49. The teacher can state the importance and the purpose of delayed retention tests.

50. The teacher can create examples of delayed retention tests for a concept, rule relationship, and cognitive strategy.

51. The teacher can state the importance of distributed practice after initial instruction.

52. The teacher can give examples of distributed practice on concepts, rule relationships, and cognitive strategies.

53. The teacher can state the importance of clarity of terms and statements, brevity, and the use of the same wording in similar tasks; e.g., "First word. What word?...Next word. What word?...Next word. What word?"

54. The teacher can create positive and negative examples of instruction that involves clarity of terms and statements, brevity, and the use of the same wording in similar tasks; e.g., "First word. What word?...Next word. What word?...Next word. What word?"

55. The teacher can state the benefits of correcting errors immediately and the negative consequences of not correcting errors.

56. The teacher can state the steps in the basic or simplest error correction format.

57. The teacher can create error correction formats for verbal associations, concepts, rule relationships, and cognitive strategies.

58. The teacher can define pre-corrections.

59. The teacher can state the benefits of pre-corrections.

60. The teacher can create examples of pre-corrections regarding participation in instruction and application of knowledge.

61. The teacher can state the importance of increasing student engaged time.

62. The teacher can identity specific ways to decrease time wasters and to increase time allocated to teaching and time engaged in teaching.

63. The teacher can state the benefits of teaching at a brisk pace.

64. The teacher typically teaches at a brisk pace.

65. The teacher can state the benefits of teaching in small, homogeneous groups.

66. The teacher can describe how to use placement tests or pre-tests to create small, homogeneous groups.

67. The teacher can identify the sorts of subjects in which small, homogeneous grouping would be useful.

68. The teacher can state the features of a learning community.

69. The teacher can state the ways that a learning community can sustain high engaged time.

70. The teacher can state methods for establishing and sustaining a learning community.

71. The teacher can state specific reasons why students have difficulty organizing and activating knowledge.

72. The teacher can state how specific scaffolding methods help students to organize and activate knowledge.

73. The teacher can describe the use of displayed lesson outlines as a method for helping students to organize and activate knowledge.

74. The teacher skillfully creates lesson outlines for display.

75. The teacher can describe the use of guided notes as a method for helping students to organize and activate knowledge.

76. The teacher skillfully creates guided notes.

77. The teacher can state how concept/proposition maps help students to organize and activate knowledge.

78. The teacher skillfully creates concept/proposition maps.

79. The teacher can state the benefits of focused initial instruction on organizing and activating knowledge.

80. The teacher skillfully plans and delivers focused instruction on organizing and activating knowledge.

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