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Developing a Scope and Sequence for Thinking Skills Instruction

The backbone of an effective thinking skills curriculum is an integrated sequential guide for introducing and reinforcing cognitive operations.

In spite of the importance of a well-organized scope and sequence for the teaching of any subject, few, if any, thinking skills scope and sequences have been disseminated. Even scarcer are explications of principles that can guide the construction of such scope and sequences. Here I suggest such basic principles with illustrations from a thinking skills scope and sequence I have developed.

Selecting the Content of a Thinking Skills Curriculum

A well-structured thinking skills scope and sequence identifies the skills and strategies to be learned throughout a curriculum; arranges them in the order in which they are to be introduced, practiced, generalized, and elaborated; and keys them to the various subjects in which they are to be taught. Such a scope and sequence provides a framework that is not overwhelmed by academic subject matter.

To build such a framework, first identify the thinking operations that will constitute your curriculum. Figure 1 presents some operations that could make up such a curriculum. I selected these skills because they are repeatedly used in most academic subjects, are commonly used outside school, and are often identified by experts as significant thinking operations. These three criteria should prove useful in selecting the cognitive operations for including in any districtwide thinking skills curriculum.

"Assign responsibility for introducing each new thinking skill or strategy to several subjects at the same grade level rather than to a single subject."

Figure 1 presents the thinking operations in three levels of complexity.

Level I. Thinking strategies are broad, inclusive, complex operations such as problem solving, decision making, and conceptualizing. These skills are described in the figure in terms of their major subordinate operations.

Level II. Critical thinking is not a process in the same sense as the Level I strategies. Rather, critical thinking is a set of discrete mental operations used to determine the worth or accuracy of something as well as a set of dispositions that guide their use and execution. These operations combine both analysis and evaluation and are used repeatedly in various stages of the Level I thinking strategies.

Level III. Information processing skills are the most basic thinking operations. Each skill is relatively simple in terms of the procedures it involves or the rules it employs. Moreover, these skills are used repeatedly in various combinations to carry out the more complex Level I strategies.

For further explication of this thinking skills hierarchy, see Beyer (1987).

Ordering Operations by Grade Level and Subject Area

Next, the thinking skills and strategies selected for instruction need to be arranged by grade level and subject area (see fig. 2). After these skills have been introduced, they must be practiced in succeeding grades in the given subjects, elaborated where they appear a second or third time in Figure 2, and then transferred to other subject areas at later grade levels. They can also be introduced or reinforced in subject areas other than those shown here, of course.

The skills in Figure 2 have been placed for introduction at the grade levels and in the subjects designated based on (1) how they relate to each other, with instruction in the less complex or prerequisite skills preceding instruction in the more complex and inclusive skills; (2) the opportunities presented by various subjects for continuing instruction in these skills; and (3) the relative ease of learning these skills as determined by presumed levels of student experience and development. The specific rationale for why these skills and strategies have been arranged as shown in Figure 2 follows.

1. *Information processing skills.* The skills of classifying and seriating (sequencing), for example, can be introduced in grades K-1 and taught to a high degree of proficiency in simple form by the end of 1st grade. Piaget and other developmentalists assert that mastery of these operations is essential to cognition and that if students do not master them by the end of the primary grades, they will be less successful at later cognitive tasks (see Inhelder and Piaget 1958). To these skills can be added instruction in comparing/contrasting and observing in grades 1 or 2, and all four can be elaborated in terms of more sophisticated attributes and applications in a variety of subjects and increasingly abstract contexts in succeeding grades. Instruction in all these skills may be provided in reading and/or social studies or language arts throughout these grade levels.

2. *Problem-solving strategies and techniques.* Starting in 3rd grade, problem solving can be introduced in mathematics and science through a simple, four-step problem-solving strategy and several basic techniques or plans for producing solutions. The number of steps in the overall strategy and the complexity of operations that constitute each step can be elaborated periodically as students progress through the grades (see fig. 2). As teachers introduce and reinforce the overall strategy, they can then use it as a framework for introducing and reinforcing a wide variety of solution plans, formulas, and techniques, such as hypothesis making and testing, working backward from a tentative answer, and so on. As these skills are introduced, students may incorporate them into the overall problem-solving strategy. After they have been taught to some degree of proficiency in the initial subject areas, problem-solving strategies and various solution plans and techniques can then be transferred to other subject areas (such as

I. Thinking Strategies

Problem-Solving
1. Recognize a problem
2. Represent the problem
3. Devise/choose solution plan
4. Execute the plan
5. Evaluate the solution

Decision-Making
1. Define the goal
2. Identify alternatives
3. Analyze alternatives
4. Rank alternatives
5. Judge highest ranked alternatives
6. Choose "best" alternative

Conceptualizing
1. Identify examples
2. Identify common attributes
3. Classify attributes
4. Interrelate categories of attributes
5. Identify additional examples/nonexamples
6. Modify concept attributes/structure

II. Critical Thinking Skills

1. Distinguishing between verifiable facts and value claims
2. Distinguishing relevant from irrelevant information, claims, or reasons
3. Determining the factual accuracy of a statement
4. Determining the credibility of a source
5. Identifying ambiguous claims or arguments
6. Identifying unstated assumptions
7. Detecting bias
8. Identifying logical fallacies
9. Recognizing logical inconsistencies in a line of reasoning
10. Determining the strength of an argument or a claim

III. Information Processing Skills

1. Recall
2. Translation
3. Interpretation
4. Extrapolation
5. Application
6. Analysis (compare, contrast, classify, seriate, etc.)
7. Synthesis
8. Evaluation
9. Reasoning (inferencing):
   - inductive
   - deductive
   - analogical

Fig. 1. Major Thinking Skills and Strategies

vocational education) on a "need-to-use" basis. Math and science are convenient vehicles for introducing both this overall thinking strategy and a wide range of specific solution plans.

3. *Critical thinking operations.* Starting in 3rd or 4th grade, selected critical thinking skills can be introduced throughout science, language arts, and/or social studies. Several of these skills can be introduced in one or more of these subjects in each succeeding year, with previously introduced critical thinking skills being practiced, elaborated, and transferred to other subjects over subsequent grades. Moreover, the skill of argument analysis may be taught as an "umbrella" operation to assist students in understanding these specific critical thinking skills. Argument analysis thus serves as a framework to which students can attach specific critical thinking skills, especially if argument analysis is gradually elaborated from identifying the components of an argument in early grades, to identify-

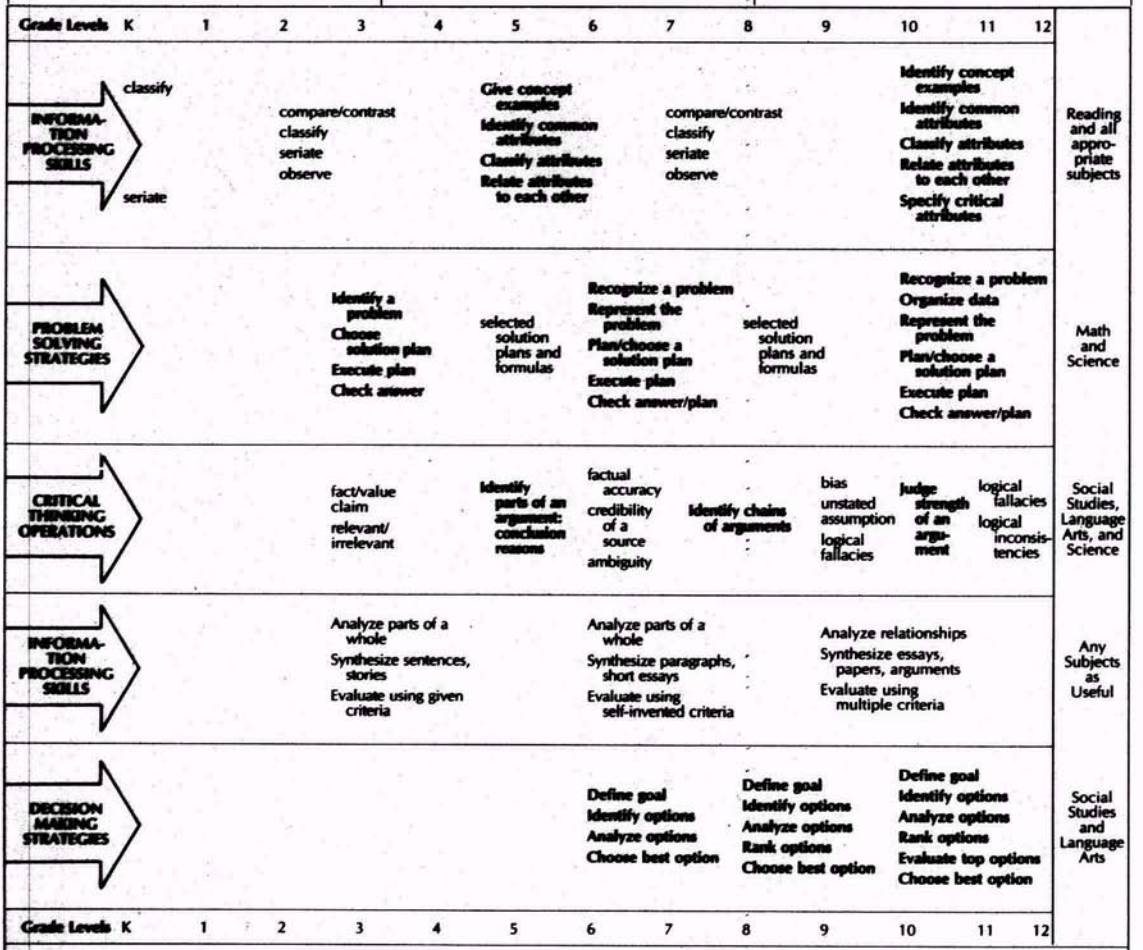

Fig. 2. A Thinking Skills Scope and Sequence

Adapted from Barry K. Beyer, *Developing a Thinking Skills Program* (Boston: Allyn and Bacon, Inc. 1988). Copyright © 1988 Barry K. Beyer

ing chains of arguments in intermediate or middle school grades, to judging the strength of arguments and producing arguments in high school grades.

4. *Analysis, synthesis, and evaluation*. Beginning in 3rd, 4th, or 5th grades, simplified versions of the more complex information-processing skills of analysis, synthesis, and evaluation can be introduced in appropriate subjects. They can be refined, added to, and transferred to other subjects in succeeding grades. Language arts is a particularly good vehicle for introducing these skills at this level because of the customary study of parts of a paragraph or story or play (analysis); creation of sentences, paragraphs, and compositions or reports (synthesis); and assessing the quality of various written productions (evaluation).

5. *Decision-making strategies*. Social studies and language arts (and health education) provide useful contexts for introducing a simplified model of decision making in the first year of middle or junior high school and for elaborating this process in subsequent years. Students at these grade levels are increasingly pressed to make important personal, academic, and even career choices. Moreover, the content of language arts and social studies courses in these grades is replete with opportunities for and examples useful in teaching this strategy. Figure 2 outlines the attributes of an increasingly sophisticated decision-making strategy that might be included in any thinking skills program.

The thinking skills scope and sequence presented in Figure 2 might well serve as the core of any school's thinking skills program. Of course, other skills might be added. The outline presented here is necessarily less detailed than it may need to be for successful implementation. For additional information on this scope and sequence, see Beyer (1988).

Structuring the Scope and Sequence

The scope and sequence described here illustrates and clarifies important principles that can guide the development of a workable scope and sequence for teaching thinking in any curriculum.

First, limit the number of thinking operations included in the curriculum. Mastery of any complex thinking operation requires repeated attention and considerable time. A K-12 program with more than two dozen thinking skills and strategies can result in skill overload and superficial teaching and learning.

Second, avoid skill overload at each grade level. In grades K-5 or K-6 introduce only two or three *new* skills at a *single grade* level or even at every other grade level. Introduce only two or three new skills in each *cluster* of related subjects in grades 6 or 7 through 12. It takes considerable time to learn a new skill and to transfer it to other contexts. While new skills are being introduced, previously introduced skills need to be elaborated and reinforced through repeated application with instructive feedback, as necessary. Skill overload must be minimized for teachers as well as for students.

Third, stagger the introduction of specific skills across grade levels and subjects, reducing the number of new operations to be learned each year in each subject, thus making it possible for students to learn thoroughly—or overlearn—these skills at first.

Fourth, assign responsibility for introducing each new thinking skill or strategy to several subjects at the same grade level rather than to a single subject. Doing so will avoid skill learning overload; help ensure skill learning proficiency even if instruction in one subject area is less than successful; and create numerous opportunities for systematic teaching for transfer. For example, assign the same two critical thinking skills to social studies and science at a given grade level, or assign the introduction of problem solving to both math and science at another grade. In either case, allow one subject area to introduce the skill formally and teach it to some proficiency in the context or media in which it was originally introduced. Then transfer the skill into the second subject while skill instruction continues in the first subject.

Fifth, build complex skills on simpler ones. That is, initially introduce skills that are prerequisite to other skills. For example, instruction in comparing, contrasting, and classifying should precede instruction in more complex forms of analyzing or synthesizing.

Sixth, provide instruction in any single skill across several grade levels. Thinking skills develop in degree of complexity over time and are useful in a variety of subjects or contexts, both in school and beyond. Instruction and independent application should continue over several years until students can use on their own initiative and without guidance a variety of thinking skills to solve problems, make decisions, conceptualize and analyze, assess, or produce arguments.

Next, introduce and teach specific thinking skills in the context of major "umbrella" strategies or related skills that give these skills utility and function. When introducing a new skill, hook it to other operations with which it is often used. Thus, specific skills such as *distinguishing relevant from irrelevant*, when introduced as part of argument analysis or of identifying a problem in the context of a problem-solving strategy, take on more value

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than if introduced merely as one of a long list of isolated skills.

Finally, go slowly. Add new thinking skills and strategies to the sequence gradually. Allow teachers to gain confidence and proficiency in their teaching of those introduced earlier before adding new skills to their teaching responsibilities.

Effective Thinking Skills Curriculums

There is, of course, more to an effective thinking skills curriculum than a list and a sequence of skills to be taught. Attention must also be given to teaching the habits and values of skillful thinking, what Robert Ennis (1985) calls "thinking dispositions" and Richard Paul (1987) calls "passions" of critical thinking. Furthermore, attention also must be given to the teaching of metacognitive strategies and techniques. For classroom instruction in thinking to be productive, scope and sequence guides need to be devised for these important dimensions of thinking also. At least one effort to develop such an integrated scope and sequence now exists (Beyer 1987), and others will undoubtedly follow.

In addition, an effective program contains (1) sample lesson plans, (2) thorough training, (3) detailed descriptions of the skills, and (4) model skills tests to incorporate into teachers' regular subject area exams. All of these resources combine to provide the support necessary for teaching thinking.

The first order of business in any effort to develop a thinking skills curriculum, though, should be to design an appropriate scope and sequence. Use of the principles presented here promises development of a scope and sequence that can contribute dramatically to making skillful thinking a reality in our classrooms.□

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