Chapter 6

The Elaboration Theory of Instruction:* A Model for Sequencing and Synthesizing Instruction

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Abstract

This paper describes a novel instructional model for sequencing, synthesizing, and summarizing subject-matter content. The importance of such models is discussed, along with the need for a significant change in the role of subject-matter structure in instruction. A "zoom-lens" analogy is presented to facilitate an understanding of the elaboration model of instruction. Some basic concepts and principles upon which the model is based are described. The basic unvarying components of the elaboration model are described. And finally, some variations in the model for different kinds of goals are described. The elaboration model follows a general-to-detailed pattern of sequencing, as opposed to the hierarchically based sequences derived from Gagné-type task analyses.

(DGT)


1 Many of the ideas described in this paper were developed under two research projects, one funded by Brigham Young University, the other by the Navy Personnel Research and Development Center. The ideas expressed here do not necessarily represent the opinions of either of these institutions. (DGT)
Introduction

This paper describes a method for sequencing, synthesizing, and summarizing instruction that the authors have been developing for about four years. Sequencing refers to decisions about the order in which to present different “topics” of a subject matter (e.g., different concepts and principles) to a student; synthesizing refers to ways of showing the interrelationships among those topics; and summarizing refers to ways of previewing and reviewing the topics that are taught. Within certain limits, selection of specific topics is also of concern herein. Since these aspects of instructional design relate to more than one topic, we refer to them as macro strategies (Reigeluth et al., 1978; Reigeluth & Merrill, 1978). Such strategies are distinct from aspects of instructional design, which relate to organizing instruction on a single topic (such as the use of matched non-examples, attribute isolation, mnemonics, divergent examples, and feedback on practice), which we refer to as micro strategies (Merrill et al., 1979; Reigeluth & Merrill, 1979).

But why are macro strategies important? Synthesizing is extremely important for most kinds of instruction because it makes the parts of the subject matter more meaningful to the student by showing their context (Ausubel, 1963, 1968)—that is, by showing how they fit into a larger picture. A more meaningful understanding has the following advantages: (1) the student will have better long-term retention of those parts; (2) the student will gain an additional kind of knowledge, one that is usually more valuable than segmented information; (3) the student will enjoy the learning more; and (4) the student will have higher motivation to learn the subject-matter content. Another major kind of macro strategy—sequencing—is important because the type of sequence is likely to influence the nature and stability of cognitive structures that a student forms and because all instructional content has learning prerequisites (Gagné, 1968, 1977). And the third major kind of macro strategy—summarizing—is important because systematic preview and review of topics can have an important influence on retention as well as on synthesizing strategies.

There are many important factors that influence the quality of the education a student receives, such as the personality of the teacher or the amount of expensive resources available; but macro strategies are particularly important because (1) they are tools that all teachers and instructional designers can learn to use to reliably improve the amount, quality, and enjoyability of the content that their students learn; and (2) they are inexpensive to implement.

A radically different function for subject-matter structure is described herein. We, like most others, had previously thought of subject-matter structure simply as a framework for designing instructional sequences. We now view subject-matter structure as that plus a lot more: structure should itself be taught—it should be a part of the instruction—in order to teach the important interrelationships within the subject matter.

There are three sections of this paper. In the first, an analogy is presented to facilitate an understanding of basic aspects of the elaboration model of instruction. Then some basic concepts and principles upon which the model is based are described. In the last section some more detailed and variable aspects of the model are explained.
The elaboration model of instruction, as described herein, represents our current, incomplete, and evolving thoughts on macro strategies. Much work remains to be done to further develop these ideas, to test their validity, and to refine procedures that will make them highly useful to instructional designers and instructors. Therefore, these ideas should in no way be construed as being "set in stone."  

An Analogy

In order to understand the nature of the elaboration model of instruction, an analogy may be helpful. Taking a look at a subject matter "through" the elaboration model is similar in many respects to looking at a picture through a zoom lens. A person usually starts with a wide-angle view, looking at the major parts of the picture and the major relationships among those parts (e.g., the composition or balance of the picture), but this view lacks much detail.

The person then zooms in on a part of the picture. He/she could be forced to zoom in on a certain part, or he/she could be given the option of zooming in on whatever part interests him/her the most. Assume that, instead of being continuous, the zoom operates in steps or discrete levels. Zooming in on one level on a given part of the picture allows the person to see the major subparts of that part and the major relationships among those subparts. Then the person should zoom back out to the wide-angle view to review the context of that part within the whole picture.

At this point several options are available. The person could zoom back in on one level to look at another part of the picture. Or he/she could zoom in on a second level for more detail or complexity on the part that he/she just viewed. Either option should be followed by zooming back out one level for context (i.e., synthesis) and review. Again, the person could be forced to follow a certain pattern; he/she could be given the option of following any of a limited number of types of patterns; or he/she could be given total freedom to follow any pattern he/she chooses, as long as no subpart is inspected before it has been seen from the next-higher level.

After viewing a set of details on a part of the picture (i.e., subparts directly below a given part), the person should always zoom back out to revisit the whole part in order to synthesize that detail—that is to see, with greater detail and understanding, the relationships among those subparts.

In a similar way, the elaboration model of instruction starts the student with a general (but not abstract) view of the subject matter to be taught. Then it divides that subject matter into parts, elaborates on each of those parts, divides those parts into subparts, elaborates on each of those subparts, and so on until the knowledge has reached the desired level of detail and complexity.

This general-to-detailed organization allows the learner to learn at the level of detail that is most meaningful (Ausubel, 1963, 1968) to him/her at any given stage in the

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2 A more general, introductory description of the elaboration model has since appeared. (See Reigeluth, 1979; Reigeluth & Rodgers, 1980). The zoom-lens analogy is just an analogy and therefore it has non-analogous aspects. One such dissimilarity is that all the detail of the picture are actually present (although usually not noticed) in the wide-angle view, whereas the detail is not there at all in the epitome. Also, detail is added in discrete steps in the elaboration model.

3 Reigeluth continued working on these ideas. See Reigeluth & Rodgers (1980); Reigeluth & Stein, 1983; Reigeluth, 1987) (DGT)
development of his/her knowledge. The learner is always aware of the context and
importance of the different topics he/she is learning and of the important relationships
among the topics that he/she has learned. And the learner never has to struggle through
a long series of learning prerequisites that are on too deep a level of detail to be
interesting or meaningful at the initial stages of instruction. As he/she works his/her
way to deeper levels of detail, increasingly complex prerequisites will need to be
introduced. But if they are only introduced at the level of detail at which they are
necessary, then there will be only a few prerequisites at each level and the learner will
want to learn those prerequisites because he/she will understand their importance for
learning at the level of detail that now interests him/her.

Unfortunately, up to now this approach has hardly been used at all in instruction.
Most instructional sequences begin with the “lens” zoomed all the way in at one corner
of the “picture” and proceed—with the “lens” locked on that level of detail—to
systematically cover the entire scene. This has had unfortunate consequences both for
synthesis and for motivation.

The lack of utilization of a zoom lens in instruction, in spite of the important
pioneering work of Ausubel over two decades ago, may be due in part to Ausubel’s
complex vocabulary and writing style and to his stress on contributing to the science of
learning instead of to the science of instruction. At about the same time, Gagné’s
hierarchical learning theory was proposed in a more straightforward manner.
Furthermore, Gagné’s work was grounded in behavioral psychology, which was in
vogue at the time, while Ausubel was espousing cognitive psychology, which was just
beginning to catch on. Our own purposes stress the science of instruction rather than the
science of learning and are highly consistent with the emerging cognitive psychology,
especially information-processing theory and schema theory. (For a discussion of the
interrelationships of our elaboration model to cognitive psychology, see Merrill et al.,
1981) In spite of a similar overall orientation to instruction, the elaboration model is
different from Ausubel’s instructional model in some important respects, and the
elaboration model is much more detailed with respect to the specification and description
of strategy components—the specifics as to how instruction should be designed. The
following is a description of some details of the elaboration model of the instruction.

Basic Concepts and Principles

Since a model is comprised of a set of interrelated principles, it may be helpful if we
describe the hypothesized principles of instruction comprising the elaboration model. But
before we can describe these hypothesized principles, it is necessary to describe several
unfamiliar concepts which are parts of some of those principles (see Reigeluth & Merrill,
1979).

Concepts

Content Construct

A content construct is a single fact, concept, principle, or step (of a procedure). Content
construct was referred to above as a single “topic,” but “topic” has a broader meaning
than does “content construct.” For instance, “history” as a topic may be very different
from history as a content construct. For more information about this distinction, see
Reigeluth et al. (1978). (See Chapter 5 of this Section.)
Subject-Matter Structure
A subject-matter structure is a set of content constructs that are grouped together on the basis of a single pervasive relationship among them. A subject-matter structure is very different from a network (Crothers, 1972; Pask, 1975; Shavelson, 1974) in that a network attempts to show more than one kind of relationship among constructs (i.e., facts, concepts, principles, or procedures). It is important to analyze a subject matter as to more than one kind of relationship; but for purposes of designing instruction, it is more valuable to derive many structures, each of which describe only one kind of pervasive relationship. It is also important to teach the student more than one kind of relationship; but we propose that it is better to teach one kind of relationship at a time. This is why it is important to define a structure as that which shows only one kind of pervasive relationship among some constructs (i.e., facts, concepts, principles, or procedures). For a more in-depth discussion of subject-matter structures, see Chapter 4 of this Section.

Subject-matter structures can be classified as orientation structures or supporting structures (see Figures 6.1a, 6.1b, 6.1c) which, when combined, form a multi-structure.

Orientation Structure
An orientation structure is a structure which is highly inclusive in that it subsumes all or most of the subject matter to be taught.

Supporting Structure
A supporting structure is a structure which is much less inclusive than an orientation structure and is nested either within an orientation structure or within a more inclusive supporting structure. It provides knowledge which supports an understanding of the structure within which it is nested.

Multi-Structure
A multi-structure is two or more related structures whose interrelationships are shown. Figure 6.1 shows a multi-structure.

An orientation structure may be any of three types: conceptual, procedural, or theoretical; and a supporting structure may be any of those same three types or it may be a learning structure.

Conceptual Structure
A conceptual structure is a structure showing superordinate/coordinate/subordinate relations among constructs. There are three important types of conceptual structures: parts taxonomies, which show constructs that are components of a given construct; kinds taxonomies, which show constructs that are varieties of a given construct; and matrices (or tables), which are combinations of two or more taxonomies. See Figures 6.2, 6.3, and 6.4 for examples of these three kinds of conceptual structures.

Procedural Structure
A procedural structure is a structure showing procedural relations among constructs. There are two important kinds of procedural structures: those which show procedural-prerequisite relations, which specify the order(s) for performing the steps of a single procedure, and those which show procedural decision relations, which describe the factors necessary for deciding which alternative procedure or subprocedure to use in a given situation. See Figures 6.5 and 6.6 for examples.
Figure 6.1. A multi-structure showing two supporting structures (b & c) and the relationship of each to an orientation structure (a).

Figure 6.1a. Orientation structure.
Theoretical Structure
A theoretical structure is a structure showing change relations among constructs. The most common kind of theoretical structure, or model, is that which shows empirical relations (see Figure 6.7). Another important kind is one which shows logical relations (see Figure 6.8). One of the major tasks of any discipline is to discover or create logical structures which are isomorphic with empirical structures.

Learning Structure
A learning structure is a structure showing learning-prerequisite relations among its constructs (e.g., it shows the critical components of principles—which are concepts—it shows the critical components or attributes of those concepts—which are also usually concepts—and so on). These are often referred to as learning hierarchies (Gagné, 1968), but other kinds of structures (e.g., parts-taxonomic structures and procedural prerequisite structures) are often confused with learning hierarchies. See Figure 6.9 for an example.
Figure 6.2. An example of a parts taxonomy. (Note: it is not complete.)

The following two concepts are important strategy components related to the elaboration model of instruction.

Epitome (e-pi’t-o.mè)

An epitome is an overview or advance organizer which epitomizes the subject-matter content to be taught in a course rather than summarizing it. It is formed by “boiling down" the course content to its essence. An epitome is a kind of overview, but unlike other overviews and summaries, an epitome includes very few constructs, and it presents them on an application level (with lots of examples and practice, as well as generalities). An epitome is derived from an orientation structure—it portrays only the most important aspects of the orientation structure (and any necessary supporting structures). For example, for a procedural orientation structure, the epitome would be a very simplified procedure (i.e., the shortest path) that subsumes all of the more detailed and complex procedures which the student needs to learn (see Figure 6.10).

Elaboration

An elaboration is a portion of instruction which provides more detailed or complex knowledge about a part of the content to be taught. A primary-level elaboration elaborates on a part of the epitome; a secondary-level elaboration elaborates on a part of a primary-level elaboration; and so on.

Principles

With these concepts in mind, here are some hypothesized principles which we believe to be valid for sequencing, synthesizing, and summarizing subject matter content...
(Reigeluth & Merrill, 1978). These hypothesized principles are likely to be valid only for instruction on a fairly large amount of subject matter (e.g., for instruction on many interrelated constructs). For instruction on a fairly small number of constructs, sequencing, synthesizing, and summarizing strategies probably do not make much difference. In effect, the following eight hypothesized principles are parts of a more general "elaboration principle"; and each of these eight could in turn be broken down into more specific parts, more detailed principles.

(1) Initial Synthesis Principle
An epitome should be presented at the very beginning of the instruction. ("Should" means that doing so will result in the instruction being more effective, efficient, and appealing.)
Content Structure and Organization

<table>
<thead>
<tr>
<th>Herbivore</th>
<th>Reptile</th>
<th>Mammal</th>
<th>Bird</th>
<th>Fish</th>
<th>Insect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turtle</td>
<td>Cows</td>
<td>Chickadee</td>
<td>Minnow</td>
<td>Ant</td>
<td></td>
</tr>
<tr>
<td>Carnivore</td>
<td>Snake</td>
<td>Lion</td>
<td>Vulture</td>
<td>Shark</td>
<td>Lady Bug</td>
</tr>
<tr>
<td>Omnivore</td>
<td>Lizard</td>
<td>Dog</td>
<td>Robin</td>
<td>Carp</td>
<td>Black Stinkbug</td>
</tr>
</tbody>
</table>

**Key:** In this matrix structure, each box is a kind of both its row heading and its column heading.

Figure 6.4. An example of a matrix structure combining two kinds of taxonomies. (Note: it is not complete.)

![Diagram](image)

**Key:** The arrow between boxes on different levels means the lower box must be performed before the higher.

Figure 6.5. An example of a procedural-prerequisite structure.

(2) **Gradual Elaboration Principle**
Aspects of the epitome should be gradually elaborated so that the sequence of the instruction proceeds from general to detailed or from simple to complex.

(3) **Introductory Familiarization Principle**
A "familiarize" (e.g., an analogy that serves to relate what is about to be learned to something similar that the learner already knows) should be provided at the beginning of the epitome and at the beginning of each elaboration. (Note: an earlier familiarize may merely be extended for a later elaboration, or a completely different familiarize may be used.)
### SELECTION CRITERIA

**Scores used on X or Y or both**

**Linear association**
- Ranks on both X and Y
- Measures which are very similar to $r_s$
- Ties on X or Y
- Easiest formula for hand calculation

**Nonlinear association**
- Simple method
- More exact method

### METHODS

<table>
<thead>
<tr>
<th>Method</th>
<th>Formula</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>PEARSON</strong> $r$</td>
<td>$r = \frac{NEXY - EXEY}{\sqrt{[NEX^2 - (EX)^2][NEY^2 - (EY)^2]}}$</td>
<td>Most Common for ranks ($r_s$)</td>
</tr>
<tr>
<td>2. <strong>SPEARMAN</strong> $r_s$</td>
<td>$r_s = 1 - \frac{6 \sum d^2}{N(N^2 - 1)}$</td>
<td>Easiest formula for machine calculation</td>
</tr>
<tr>
<td>2a.</td>
<td>$r_s$ FOR MACHINE X and Y are ranks</td>
<td>Between ranks</td>
</tr>
<tr>
<td>2b.</td>
<td>$r_s$ WITH TIES</td>
<td>See Method Outline</td>
</tr>
<tr>
<td>3. <strong>KENDALL TAU</strong> ($r_y$)</td>
<td>See Method Outline</td>
<td></td>
</tr>
<tr>
<td>3a.</td>
<td>$r_y$ WITH TIES</td>
<td>See Method Outline</td>
</tr>
<tr>
<td>4. <strong>Point Biserial</strong></td>
<td>$r_p = \frac{M_2 - M_1}{S} \sqrt{\frac{n_1 n_2}{N(N-1)}}$</td>
<td>Enter this value of $S$ into method 4.</td>
</tr>
<tr>
<td>4a.</td>
<td>$s = \sqrt{\frac{N(N-1)}{n_1}} \left[ S^2 + \frac{(N(n_2)-1)S^2}{n_2} \right]$</td>
<td>No within-category means and standard deviations been computed?</td>
</tr>
<tr>
<td>5. <strong>GLASS RANK-BISERIAL CORRELATION</strong></td>
<td>$r_g = \frac{2(M_2 - M_1)}{N}$</td>
<td>OD curve not drawn</td>
</tr>
<tr>
<td>5a.</td>
<td>$r_g = 1 - \frac{2}{g}$ (proportion of area under OD curve)</td>
<td>OD curve drawn</td>
</tr>
<tr>
<td>6. <strong>CORRELATION RATION</strong> ($\gamma^2$)</td>
<td>See Method Outline</td>
<td></td>
</tr>
<tr>
<td>7. <strong>PHI</strong></td>
<td>$\phi = \frac{AD - BC}{\sqrt{(A + B)(C + D)(A + C)(B + D)}}$</td>
<td>Two dichotomous variables</td>
</tr>
<tr>
<td>7a.</td>
<td>$\phi$ USING MARGINAL PROPORTIONS</td>
<td>Formula using marginal proportions</td>
</tr>
<tr>
<td>8. <strong>YULE</strong></td>
<td>$q = \frac{AD - BC}{AD + BC}$</td>
<td>Two categorical variables</td>
</tr>
</tbody>
</table>

Figure 6.6. Part of a procedural structure showing procedural-decision relations among alternate procedures.
(4) "Most Important First" Principle
Whatever one judges to be the most "important" aspect of the remaining orientation content should be elaborated on first. Importance is estimated by a subject-matter expert on the basis of contribution to the student's understanding of the whole "picture." This will result in more meaningful learning, with its attendant increase in motivation, transfer, and long-term retention. If two parts of the epitome are judged to be equal with respect to this criterion of importance, then the subject-matter expert should use such criteria as frequency of use in the real world or the seriousness of the consequences of inadequate use in the real world. The rationale here is that the sooner a part of an epitome is elaborated the better it will be learned, because the learner will gain more practice in doing and integrating that part by the end of the instruction.

(5) Optimal Size Principle
Each elaboration should be short enough that its constructs (i.e., facts, concepts, procedures, and principles) can be recognized comfortably by the student and synthesized comfortably by the instruction, yet long enough that it provides sufficient depth and breadth of elaboration. This optimal size is related to the limits of short-term memory; also it is probably influenced by cognitive processing abilities (which are a
function of mental maturity) and by certain subject matter characteristics (such as the novelty of the constructs, the degree of abstractness of the constructs, and the type of relation being synthesized). This is an important area for future research.

(6) Periodic Synthesis Principle
A synthesizer (e.g., a subject-matter structure) should be provided after each elaboration, in order to teach the relations among the more detailed constructs that were just taught and to show the context of the elaboration within the epitome.

(7) Periodic Summary Principle
To facilitate synthesis, a summarize (i.e., a concise generality for each construct) should be provided before each synthesizer.

(8) Type of Synthesizer Principle
The following types of synthesizers should be used under the indicated conditions: a conceptual structure (taxonomic or matrix) for conceptual content, a theoretical structure for theoretical content, and a procedural structure for procedural content.
The Elaboration Model

Models show how things work. One can conceptualize models as being of two kinds: (1) descriptive models, which describe natural phenomena and are invariant, and (2) prescriptive models, which describe ways to achieve some end and therefore vary as goals vary. This distinction parallels the difference between descriptive sciences, such as the science of learning, and prescriptive sciences, such as the science of instruction (Reigeluth et al., 1978; Simian, 1969; Snelbecker, 1974). The elaboration model of instruction is prescriptive; it prescribes ways to achieve given goals.
One could conceptualize two aspects of goals of instruction. One aspect is the nature of the general goals of a course of instruction. These general goals could be classified as effectiveness, efficiency, and appeal; and they are fairly uniform for all instruction—that is, one wants the student to learn what is taught (effectiveness), one wants the student to achieve a given level of learning with a minimum of student time (efficiency), and one wants the student to enjoy the instruction (appeal). Since these goals do not vary much from course to course, the model does not vary with respect to these ends; it assumes all three should always be maximized.

The other aspect of goals of instruction is the nature of the orientation goals of a given course. These orientation goals could be classified as conceptual, procedural, or theoretical in orientation (see above). Since the kind of orientation varies from course to course, the model must vary with this kind of goal.

In the next segment we will describe the aspects of the model which do not vary from course to course. Then in the following segment we will describe aspects which do vary from course to course.

Unvarying Components of the Model

Keeping in mind the foregoing analogy of the zoom lens, the following is a general description of the elaboration model of instruction (see Figure 6.11). The technical terms used herein are defined in the previous section on concepts. (For an earlier version of this model, see Merrill, 1977.)

(1) The instruction begins with an epitome, which provides an overview of the subject matter by teaching the most important content constructs in the orientation structure and by teaching the supporting structures related to those constructs. This epitome starts with a familiarize which relates what is about to be learned to something similar that the student already knows.

(2) The instruction provides a primary elaboration on each aspect of the epitome, beginning with the most “important” aspect. Importance is estimated by a subject-matter expert on the basis of such factors as contribution to understanding the whole picture, frequency of use, or seriousness of consequences of a mistake. Each primary-level elaboration adds detail or complexity to the general understanding of each aspect of the epitome by elaborating on the next most important aspect of the orientation structure and by presenting the supporting structures related to that aspect. At the beginning of each primary-level elaboration, a familiarize is provided to relate what is about to be learned to something similar the student already knows.

(3) At the end of each primary-level elaboration, the instruction provides a summarize followed by an expanded epitome (an external synthesizer). The summarize gives a concise generality of each construct that was taught in the elaboration, and the expanded epitome shows (a) the important relationships among the parts of the elaboration and (b) the relationship of the elaborated parts to the (expanding) epitome of the orientation structure.

(4) After all of the primary-level elaborations have been presented and integrated with the ever-expanding epitome of the orientation structure (see Figure 6.12), the instruction presents secondary-level elaborations—which elaborate on each primary-level elaboration rather than on the epitome—if such is necessary to bring the student to the depth of understanding specified by the objectives of the instruction. Like its primary-level counterpart, each secondary-level elaboration is initiated with a familiarize.
(5) At the end of each secondary-level elaboration, the instruction provides a summarize and an expanded epitome, similar to those at the end of each primary-level elaboration.

(6) After all of the secondary-level elaborations have been presented, synthesized, and integrated into the expanded epitome, then the pattern is repeated for tertiary-level elaborations, quaternary-level elaborations, etc., if such are needed to bring the student to the depth of understanding specified by the objectives of the instruction.

(7) At the very end of the instruction, a terminal epitome is presented to synthesize the entire domain of the subject matter. This terminal epitome is not merely an extended review of each of the content constructs. Rather, it is a final articulation of the structure of the content; it reviews the relationships taught and integrates the various layers of elaborated content.

Variations of the Model

There are many possible variations of this model. In reference to the zoom-lens analogy, the instruction could zoom in on just one primary-level elaboration before zooming in on its secondary-level elaborations, rather than zooming in on all primary-level elaborations before zooming in on any secondary-level elaborations. Or the learner could be given control over the sequencing of elaborations (Reigeluth, 1979). However, we hypothesize that the most cost-effective variation is the one that was just described in some detail and was illustrated in Figure 6.12.

Assuming that the most cost-effective variation were known, it is likely that the above-described aspects of the model would not vary from course to course—that is, the instructional components described would always all be present and in the same order.
However, there are two ways in which this model may systematically vary from one kind of course to another.

First, the nature of the major strategy components described varies with the type of orientation goal. Although their presence and their order would probably not change, the epitome, the elaborations, and the synthesizers all vary considerably depending upon whether the orientation goals are conceptual, procedural, or theoretical. Below is a description of those variations and when each should be used.

The second way in which this model may vary from one course to another is that the epitome, elaborations, and synthesizers are usually based on a number of interrelated structures (i.e., a multi-structure) rather than on a single structure. These variations are also briefly described below.
Epitome

The nature of the epitome and the procedures for creating it are different for each type of orientation goal: conceptual, procedural, or theoretical. The following is a description of the nature of the epitome for each type of orientation goal.

Conceptual

Like all epitomes, a conceptual epitome has two major parts: a synthesizer and the instruction necessary to understand that synthesizer. The synthesizer in this case is a conceptual structure, but this synthesizer must be a very simple or general version of the conceptual orientation structure, and it must subsume the majority of the subject matter that is to be taught. It should contain the maximum amount of material that a student can learn comfortably in one lesson (e.g., in perhaps a one-hour sitting). Generally, it is the top portion of the taxonomy (or, in the case of a matrix, it is the top portion of the taxonomies that comprise the matrix). Such a conceptual synthesizer is shown in Figure 6.13.

![Figure 6.13. A matrix structure as a conceptual-epitome synthesizer for a course in English composition.](image)

The instruction necessary for the student to understand the epitome’s synthesizer will usually include generalities, instances, and practice on each concept and on the relations portrayed in the synthesizer (see Section 3 of this book). The instances and practice do not have to be abstract; in fact, they should be concrete, real-life cases. But they should be chosen or generated so as to be simple enough for the student to be able to learn at the initial stages of the instruction. In order to teach each concept in the synthesizer, it may be necessary to identify its learning prerequisites, and to include them in the instruction if they cannot be assumed as entering knowledge of the students.
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Procedural
A procedural epitome is also comprised of a synthesizer and the instruction necessary to understand that synthesizer. In this case the synthesizer is a procedural structure (either procedural-prerequisite or procedural-decision). Again it must be a very simple or general version of the complete procedural orientation structure, and it must subsume the majority of the subject matter that is to be taught. Aside from its being a different kind of structure, the major difference between this and a conceptual-epitome synthesizer is that this kind of synthesizer cannot be formed merely by "pruning" off a part of the orientation structure; rather a more simple but parallel procedural structure needs to be created (see Reigeluth & Rodgers, 1980). Such a simplified procedural synthesizer is shown in Figure 6.10.

The instruction necessary for understanding the epitome's synthesizer will include generality instances-practice instruction (see Section 3 of this book) on each step (construct) and on the relation portrayed in the synthesizer. The instances and practice should be real-life cases that are chosen or generated so as to be simple enough for the student to learn at the initial stages of the instruction. For example, in reference to Figure 6.10, the method of statistical analysis may be an extremely simple one having only a few steps, or it may be a complicated procedure that can be simplified by providing inputs that reduce it to just a few steps. For all steps which involve concept classification, those concepts will need to be taught (if they are not entering knowledge of the students); and their learning prerequisites may need to be identified and included in the instruction (if they cannot be assumed as entering knowledge of the students).

Theoretical
A theoretical epitome is also comprised of a synthesizer and of the instruction necessary to understand it. In this case the synthesizer is a theoretical structure (either empirical or logical). Again it must be a very simple or general version of the complete theoretical orientation structure, and it must subsume the majority of the subject matter to be taught. Sometimes this kind of synthesizer can be formed by merely "pruning" off a part of the orientation structure (as for the conceptual epitome), but sometimes a simple/generalized parallel structure must be created (as for the procedural epitome). In either case, the historical development of the principles and theories in a subject matter often provides an excellent pattern for deriving the epitome synthesizer and its subsequent elaborations (see below). Such a simplified/generalized theoretical synthesizer is shown in Figure 6.14.

The instruction necessary for understanding the epitome's synthesizer will include generalities, instances, and practice on each construct and on the theoretical relations in that synthesizer (see Section 3 of this book). Again the instances and practice should be real-life cases that are on a simplified level. (For example, in reference to Figure 6.14, the student should be shown actual instances of the effects of changes in demand on changes in price.) The theoretical structure is comprised primarily of concepts, and therefore their learning prerequisites may also need to be identified and included in the instruction.

Expanded Epitomes
The expanded epitomes are basically the same as the epitome synthesizer for each type of orientation goal (conceptual, procedural, and theoretical), except that they are synthesizers which are correspondingly extended to include more complexity or detail.
The Law of Supply and Demand

Figure 6.14. A simplified generalized theoretical structure as a theoretical-epitome synthesizer.

Elaborations

The nature of the elaborations and of the procedures for creating them are also different for each type of orientation goal: conceptual, procedural, or theoretical. The following is a description of the nature of the elaborations for each type of orientation goal.

Conceptual

Like all elaborations, the conceptual elaborations gradually lead the student from a very general understanding of the subject matter to be taught (i.e., from the epitome or the wide-angle view) to the level of complexity or detail specified by the objectives. In this case, each elaboration teaches concepts which are subordinate to a general concept that has already been taught, either in the epitome (for primary-level elaborations) or in an elaboration (for lower-level elaborations). In other words, the topics of an elaboration are the parts or kinds (depending upon the type of conceptual structure) of a general concept or concepts. Each elaboration may also include the content of one or more supporting structures.

Regardless of the type of elaboration (conceptual, procedural, or theoretical), the amount of material within each elaboration must be gauged to the ability level of the learners. If there is too much material, it will be too difficult for the student to synthesize (due to an excessive memory and assimilation load), and the student will be less motivated (due to a greater difficulty in keeping the whole "picture" in mind). In an introductory course for graduate students, much more material should be included in each elaboration than in an introductory course for junior high school students. The amount of material in an elaboration may be adjusted either by changing the breadth of the elaboration or by changing the depth of the elaboration. For fairly simple material, a
single elaboration could include an entire row of a taxonomy or of a matrix, or it could entail going three levels deep on a single box in the epitome.

Procedural
Each procedural elaboration provides its detail or complexity on a single step of the procedural epitome, or by adding an alternate path (see, e.g., P. Merrill, 1978). Therefore, the amount of material within an elaboration should be adjusted only by changing the depth of the elaboration (with the exception that two steps of the epitome could be included in an elaboration if they both have little depth, or two alternative paths could be added if they both have little depth). This is the most important difference from the conceptual elaboration.

Theoretical
Each theoretical elaboration provides its complexity by teaching principles that are successively more local, detailed, and complex. These elaborative principles usually relate to a single aspect of the elementary model in the epitome. As with the procedural elaboration, the amount of material within a theoretical elaboration can usually be adjusted only by changing the depth of the elaboration (but again, two aspects of the elementary model could be included in an elaboration if they both have little depth). Many textbooks which follow the historical development of a discipline come fairly close to this paradigm of instructional organization.

Internal Synthesizers
The internal synthesizers in each elaboration are very similar to the synthesizer which is part of the epitome. The major difference is its scope: it synthesizes only the constructs that comprise one supporting structure in the elaboration, and it does not show the context of those constructs within the larger picture.

Conceptual
A conceptual internal synthesizer is a conceptual structure that shows super/co/subordinate relations among its concepts. It may show parts-ordinate relations, kinds-ordinate relations, or both. Usually this internal synthesizer is just a few levels of a conceptual structure.

Procedural
A procedural internal synthesizer is a procedural structure that shows the order relations among its event concepts (steps). It may show either procedural-prerequisite relations or procedural-decision relations. This internal synthesizer is usually a relatively small procedure.

Theoretical
A theoretical internal synthesizer is a theoretical structure that shows the theoretical relations (usually causal) among its constructs. It may show either logical or empirical theoretical relations. And this synthesizer is usually a small model or a part of a larger theoretical structure.
Multi-Structures

We mentioned above that the epitomes, elaborations, and synthesizers comprising a course are usually based on a number of interrelated structures rather than on a single structure. We refer to such a set of interrelated structures as a multi-structure. In the section on epitomes, it was indicated that learning structures may be needed in the design of the instruction on the epitome synthesizer, in order to teach the learning prerequisites for each concept comprising the epitome synthesizer. But learning structures are not the only kind of structure that can be nested within an orientation structure in an epitome or an elaboration.

Given, say, a theoretical orientation structure, the nature of the goals of the course may call for teaching certain efficient procedures associated with different parts of the theory or model. In such a case, procedural structures would be nested within the theoretical orientation structure, and some of the elaborations would elaborate on procedures rather than on parts of the theory or model. Similarly, some internal synthesizers would be procedural and some expanded epitomes would be multi-structural.

Summary

In this chapter we have described an instructional model for sequencing, synthesizing, and summarizing subject-matter content. The importance of such a macro strategy was discussed, and it was emphasized that the elaboration model of instruction represents a significant change in the role of subject-matter structure in instruction.

First, the zoom-lens analogy was presented to facilitate an understanding of the nature of the elaboration model of instruction. A student starts with a wide-angle view of the subject matter and proceeds to zoom in for more detail on each part of that wide-angle view, zooming back out for context and synthesis. In some cases, it may be best for a learner to pan across the entire subject matter on one level before zooming in for more detail on any part, whereas in other contexts it may be best for the learner to continue to zoom in on one area before zooming in at all on any of the other areas. In still other contexts, it may be best to let the student follow his/her interests, as long as he/she uses a zoom-in pattern rather than a zoom-out pattern.

Second, some basic concepts and principles upon which the elaboration model is based were described. The concepts were: content construct, subject-matter structure, orientation structure, supporting structure, multi-structure, conceptual structure, procedural structure, theoretical structure, learning structure, epitome, and elaboration. The hypothesized principles were: (1) the initial synthesis principle, (2) the gradual elaboration principle, (3) the introductory familiarize principle, (4) the "most important first" principle, (5) the optimal size principle, (6) the periodic synthesis principle, (7) the periodic summary principle, and (8) the type of synthesizer principle.

Third, we distinguished between two kinds of models and expressed the need for a model which describes ways to achieve some end in instruction. Since general goals (ends)—such as effectiveness, efficiency, and appeal—do not vary much from course to course, the elaboration model of instruction is fairly constant in aspects related to these goals. But since orientation goals (ends)—such as conceptual, procedural, or theoretical orientations—do vary from course to course, the elaboration model varies from course to course with respect to aspects related to these goals. This conceptual/procedural/theoretical distinction is one of the most important advances of the elaboration model.
Fourth, the basic unvarying components of the elaboration model of instruction were described: an epitome, the primary-level elaborations, the summarize and expanded epitome following each primary-level elaboration, the secondary-level elaborations, the summarize and expanded epitome following each secondary-level elaboration, and the terminal epitome summarizing the entire course, both its constructs and its relations.

Fifth, and finally, we described the variations of the elaboration model for different courses. Some different patterns of sequencing, including learner control, were briefly mentioned. Then the nature of the epitome, the expanded epitome, the elaborations, and the internal synthesizers were described for each kind of orientation: conceptual, procedural, and theoretical. And, finally, we discussed the use of diverse multi-structures as a basis from which to design and organize the instruction.

References


