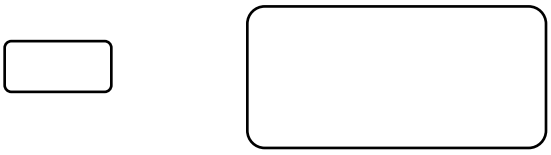
Chapter 2

Basics of Scope and Sequence

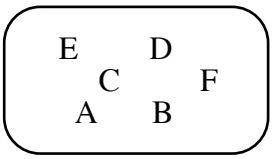
What Are Scope and Sequence?

Scope decisions are decisions about what to teach—the nature of the content.[1] They require decisions about what the learner needs and/or wants to learn. **Sequence decisions** are concerned with how to *group* and *order* the content. You can't order the content without creating some kind of groupings to be ordered, and different kinds of sequences require different kinds of groupings They require several types of decisions—regarding:

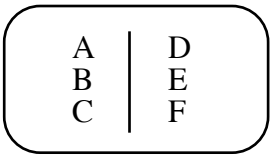
- the size of each group of content (learning episode)



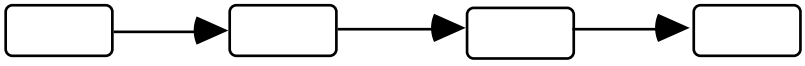
- the components of each learning episode



- the order of components within each episode, and



- the order of episodes



[1] I use the term "content" to refer to everything that comes under "what to teach." It therefore, includes whatever tasks you might teach as well as whatever knowledge, and the term "content analysis" includes "task analysis."

—all of which influence the quality of the instruction: its effectiveness, efficiency, and appeal.

Does Scope Make a Difference?

If you are in a training department for any of the three sectors (private, public, or nonprofit), the employees or customers need certain skills and knowledge to perform well. If you don't teach what they need, it doesn't matter how good the remaining aspects of the instruction are.

However, a k-12 or higher education context is very different in that needs are much less clear and depend largely on values. Furthermore, students have interests that may be unrelated to the values that the community and the parents hold. And the benefits of the instruction may not become apparent until many years later. All of these factors make it much more difficult to say whether scope makes a difference, or perhaps more accurately, what kinds of difference scope makes. Clearly, the differences scope makes will vary from one student to another and from one "stakeholder" to another in the educational system. (Stakeholders are all those who have a stake in the particular educational system, such as parents, employers, taxpayers, students, social service agencies, and so forth). But ask any student or any stakeholder whether "what is taught" makes a difference to them, and you are almost certain to get a resounding "Yes!"

General Concerns for Deciding on Scope

So, if scope does make a difference, how can you make sure that you select the right content?

Training Contexts

For training contexts, the answer is fairly straightforward. You conduct a needs analysis. Much has been written elsewhere about how to conduct a needs analysis (see e.g., Kaufman & English, 1979; Kaufman, Rojas & Mayer, 1993: Rossett, 1987), so I will not say much about it here. But two points are worth emphasizing. First, your needs analysis can take a nonsystemic, partial systemic, or total systemic approach. The partial and total systemic approaches are two major alternatives for boxes 1.1 and 1.2 in the Indiana ISD Model on p. 2.

If you take a **nonsystemic approach**, you look for performance problems in the organization, and you try to design training solutions for those problems. You don't look beyond knowledge and skill deficiencies in the organization's

employees or customers. (I use the term, "customers," in the broader sense of all those whom the organization serves.) The nonsystemic approach is not a wise approach.

If you take a **partial systemic approach**, you analyze *all* the causes of, and potential solutions to, the organization's performance problems, and you select the best set of options. This may include changes in the incentive systems, equipment, work organization, and management systems—as well as the knowledge and skills—of the employees or customers (again, defined very broadly).

If you take a **total systemic approach**, you will strive to be a "learning organization" (Senge, 1990), which means you will start by looking outside the organization to the relationships between the organization and its customers. How well is the organization meeting its customers' needs? How are their needs changing? Do they (or other potential customers) have other needs that are not being met well, to which you might be able to respond? The focus here is not so much on analyzing problems as analyzing opportunities. Once the needs and opportunities are identified, you analyze *all* the potential means of responding to them and select the best set of options. As with the partial systemic approach, this may include changes in the incentive systems, equipment, work organization, and management systems—as well as the knowledge and skills—of the employees or customers. But it also may include making changes in the goals or mission of the organization, as well as meeting its goals. In systems terms, this is called a "purpose-seeking" organization.

Education Contexts

For k-12 and higher education contexts, it is more difficult to make sure that you select the right content, for all the reasons outlined earlier:

- needs are much less clear
- needs depend largely on values
- students have interests of their own
- benefits may not become apparent until many years later.

But it is also possible to take either a systemic or a nonsystemic approach to selecting content (scope).

The **nonsystemic approach** entails responding to problems within the system, such as state curriculum guidelines, state achievement tests, and national textbooks. This approach does not consider the desires of parents, the needs or interests of students, or the needs of employers in any systematic way. It is a standardized, top-down approach to selecting content.

The **systemic approach** explores the needs of all those who have a stake in the educational system, including the students, parents, and other community

members (such as employers, social service agencies, and other local organizations). Because of the likelihood of considerable differences of opinion about what should be taught, it is important to engage the diverse stakeholder groups in dialogue with each other, in which everyone tries to understand why each individual believes what they do, and through that process, for everyone's thinking to evolve in ways that help them to reach some consensus about content for all students to master. Involving all the stakeholders in the content selection process not only provides valuable input for selection decisions, but it also provides the stakeholders with a sense of ownership over their educational system.

Just as the business world has been evolving from standardization to customization, a systemic content selection process is likely to reveal that students should not learn *all* the same things. Osin and Lesgold (1997) talk about "defining a required common curriculum and supporting additional student choices" (p. 642). The Indiana Curriculum Advisory Council (1991) came to a similar conclusion, after much input from many stakeholder groups:

> The intent of 21st Century Schooling is to invent schools which give each child access to the conditions which make possible learning achievement to the limits of individual ability. ... Required will be a 180 degree shift in Indiana's educational policy: from a narrow, rigid focus on covering isolated content, to a sensitive, responsive focus on each student. (p. 1)

Technology is evolving to the point where we can create flexible, computer-based, learning tools that students can use—while they are learning—to create or modify their own instruction. Furthermore, with team-based learning, different teams can pursue different interests, with the teacher assuming the role of a coach or guide steering the teams to appropriate resources, many of which utilize advanced technologies. This means that students will be able to make decisions about what to learn (and even about how to learn it) while the instruction is in progress.

Therefore, much of the content selection that is now done by a teacher (or curriculum committee) for a whole "batch" of learners well ahead of the actual instruction could soon be done during the instruction as multimedia systems (and the teacher) continuously collect information from individual learners and/or small teams of learners and use that information to present an array of sound alternatives to the student(s), both about what to learn next and how to learn it. The learner's decisions will, in all likelihood, be tempered by collaborative input from the teacher and parents. However, I would hasten to reemphasize that there will likely be some content that the stakeholders will believe all students should learn (or that students with certain interests should learn), and the stakeholder-based selection process outlined a few paragraphs earlier should be used to make that decision.

Does Sequencing Make a Difference?

This is a very common type of question to ask, but it is the wrong type! The issue, as with most instructional strategies, is not whether it makes a difference, but when it makes a difference and when it doesn't. The impact of sequencing depends upon two major factors: the strength of relationships among the topics and the size of the course of instruction.

Sequencing is only important when there is a strong **relationship among the topics** of the course. If a course is composed of several unrelated topics, such as word processing, computer graphics, and electronic spreadsheets, the order for teaching the topics is not likely to make any difference, because there are no important relationships among the topics. On the other hand, when there is a strong relationship, the sequence used will influence how well both the relationship and content are learned. For example, there is an important relationship between the analysis and design phases in the ISD process. Some sequences take a fragmented approach that makes it difficult to learn the relationship and understand the content, whereas other sequences facilitate such learning.

Second, if there is a strong relationship among the topics, then as the **size of the course** increases, so does the importance of sequencing. When the content requires more than about one hour to learn, sequencing is likely to begin to make a significant difference in the learners' ability to master it, because most learners will have a difficult time organizing so much content logically and meaningfully if it is poorly sequenced. However, when the content to be learned is minimal (e.g., less than about 1 hour), the human mind can compensate for weaknesses in the sequence.

Types of Sequencing Strategies

Relationships Are the Key

The importance of relationships is twofold. As was just mentioned, if no relationships exist, then sequencing doesn't matter. But the second is that each method of sequencing is based upon a **single type of relationship**. For instance, a historical sequence is based upon the chronological relationship—a sequence is devised that follows the actual sequence of events. A procedural sequence, the most common pattern of sequencing in training, is based upon the relationship of "order of performance" of the steps in the procedure. A hierarchical sequence is based upon the relationship of learning prerequisites among the various skills and subskills that comprise a task. And the "simplifying conditions" sequence (described later) is based upon the

relationship of the degree of complexity of different versions of a complex task.

Furthermore, when a number of topics need to be taught, two basic patterns of sequencing can be used that are fundamentally different: topical and spiral (see Figure 2.1).

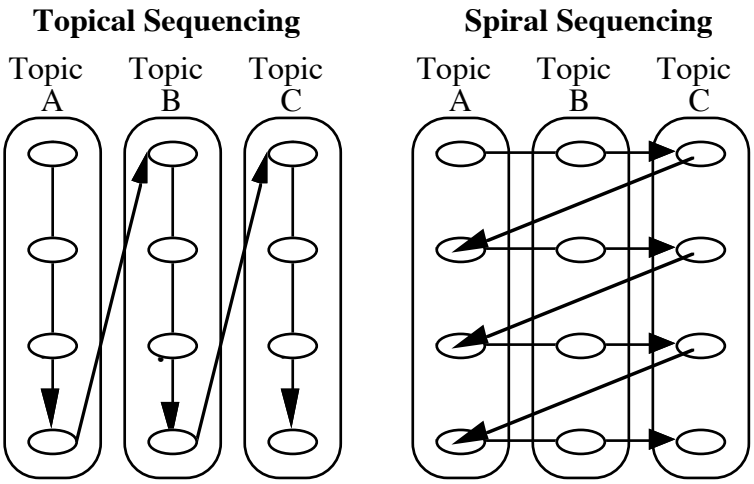


Figure 2-1: Topical and Spiral Sequencing

(From Reigeluth & Kim, 1995)

Topical Sequencing

In topical sequencing, a topic (or task) is taught to whatever depth of understanding (or competence) is required, before moving to the next one. There are both advantages and disadvantages of topical sequencing. Learners can concentrate on one topic (or task) for in-depth learning without frequently skipping to new topics. And hands-on materials and other resources are all used in one block of time, rather than being used at different points scattered over several months or a year. However, once the class (or team or individual) moves on to a new topic (or task), the first one can easily be forgotten. And the learners don't gain a perception of what the whole **subject domain** is like until they reach the end of the course (or curriculum). The weaknesses of topical sequencing can be compensated for, to some extent, by incorporating tactics for overview, review, and synthesis.

Spiral Sequencing

In spiral sequencing, the learners master a topic (or task) gradually in several passes. The learner learns the basics of one topic (or task), then another, and

another, and so on, before she or he returns to learn each topic in greater depth. The learner spirals back through all the topics (or tasks), learning each one in greater depth with each pass, until the necessary depth is reached for all of them.

The main advantage of spiral sequencing is its built-in synthesis and review. The interrelationships among topics (or tasks) may be learned more easily using the spiral approach because it allows similar aspects of the various topics (or tasks) to be learned close in time to each other. Furthermore, cycling back to learn an earlier topic (or task) in greater depth provides a periodic review of the earlier one. On the other hand, the main disadvantage of spiral sequencing is disruption. Once a particular topic (or task) has been started, learners get into a particular frame of mind (schema). Frequently switching disrupts the learners' thought development. In addition, switching may disrupt the efficient management of material resources needed as you progress from one topic (or task) to the next.

Which One Is Best?

Again, this is a very common type of question, but the wrong type of question! The issue is not which pattern of sequencing is best, but when is each best. Furthermore, in reality neither topical nor spiral sequencing exists in a pure form. In an extreme case, spiral sequencing could entail presenting only one sentence on each topic (or task) before spiraling back to make another pass on a deeper level. The real issue lies in how deep a slice a teacher or learner makes on one topic (or task) before going on to another. Rather than thinking of spiral and topical sequencing as two separate categories, it is useful to think of them as the two end-points on a continuum. The instructional designer's (or learner's) decision, then, is where on the continuum to be for any given training program or curriculum.

General Guidelines for Sequencing

The following are some guidelines and principles for sequencing, organized by the order in which decisions need to be made.

Is Sequencing Important?

Decide whether or not sequencing is likely to make a difference (Box 2.2 on p. 2). To make this decision, you need to analyze the amount of content and the degree of relationship among elements of the content (Box 2.1 on p. 2). If you are teaching a small amount of content (less than about 1 hour of instruction), or you are teaching unrelated topics, then sequencing is not likely to make a difference, and you can skip the rest of these guidelines and just use

your common sense. Be sure to include in the decision-making process the major people who will be implementing the instruction (Box 2.4). Once you have made the decision, evaluate it by consulting more than one person who is experienced in teaching this content (or task) (Box 2.3). They may be the same people you included in the activity for Box 2.4.

What Kind of Sequence?

If sequencing is likely to make a difference, then you need to decide what kind of sequence to use (e.g., procedural, hierarchical, simplifying conditions, or elaboration). To make this decision, you need to analyze the nature of the content (Box 2.1). Again, you should include experienced instructors and other end-users in the decision-making process (Boxes 2.4 and 2.3, respectively). Chapter 3 addresses considerations for making this decision.

Design the Scope and Sequence

Once you have decided on the kind of sequence to use, then you need to apply the corresponding scope and sequence methodology to the content (Box 2.2). To do this, you need to perform the appropriate type of content (or task) analysis [e.g., the procedural sequence requires procedural analysis (see Chapter 4), the hierarchical sequence requires learning prerequisite analysis (see Chapter 5), and so forth] (Box 2.1). The process of conducting the content analysis yields decisions simultaneously about what content to teach (scope), how to cluster it into learning episodes (grouping), and what order to teach those learning episodes (sequence). The following are some general principles that can facilitate making these decisions.

The first factor to consider for sequencing is the **size of each learning episode** (set of related knowledge and skills). If the learning episode is too big, the learners may forget the early instruction before they have had a chance to review and synthesize what they have just learned. On the other hand, if the learning episode is too small, it will fragment the instruction. The size of each learning episode should also be influenced by the time constraints (if any) of the instructional situation (Box 2.1). For example, if you are constrained to 2-hour blocks of time for teaching, then each learning episode should contain two hours worth of instructional content (or multiples of 2). Again, you should include end-users and other stakeholders in the decision-making process (Box 2.4), and have experienced instructors evaluate the resulting sequence (Box 2.3).

Second, in addition to considering the size of each learning episode, the **components of each learning episode** should be considered. The components should be selected based on the relationships among learning episodes that you wish to utilize for your sequence. If you use a procedural sequence, you should include in a learning episode all those steps (and only

those steps) that are performed in the same period of time. If you use a hierarchical sequence, you should include in a learning episode only those skills that are prerequisites for the same skill (or set of skills).

Third, the **order of learning episodes** should be considered. Presenting too much complexity too soon or presenting the learning episodes in an illogical order will discourage the learner, slow down the learning process, and reduce the chances of mastery of the topic (or task). The order of learning episodes will also depend on the relationship chosen. If you choose a procedural sequence, each set of steps (which constitutes a learning episode) should be taught in the order in which it is performed by an expert.

Design the Within-Episode Sequences

Once you have finalized the content for your learning episodes and sequenced the learning episodes, you need to sequence the content within each learning episode (Box 2.2). Sequencing of such elements as prerequisites and relevant information, understandings, and attitudes can influence the quality of the instruction. For example, if you teach nothing but the prerequisite skills (which are less interesting) in the first half of the learning episode, learners may become bored and give up before they taste the real flavor of the topic (or task); and they may forget the earlier ones before they have an opportunity to use them.

A variety of principles of sequencing are likely to be relevant here, such as "Teach prerequisites immediately prior to when they are needed" and "Teach understanding before efficient procedures." Each of those principles of sequencing requires a different type of analysis of the content (Box 2.1). And, of course, you should include end-users and other stakeholders in the decision-making process (Box 2.4), and have experienced instructors evaluate the resulting within-learning episode sequences (Box 2.3). Chapters 4-7 address considerations for making these decisions.

The components of each learning episode and the order of learning episodes are strongly interrelated. The order of learning episodes will be influenced by the components of the learning episodes. Therefore, the order of learning episodes should be selected by first determining which **relationship(s)** should be emphasized and therefore the components each learning episode should have. Chapter 3 will provide some guidance for making this decision.

References

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