

An Evaluation of the Elaboration Model of Instruction

from the Perspective of Assimilation Theory

Richard E. Mayer
Department of Psychology
University of California
Santa Barbara, CA 93106

Abstract. This paper provides a critical analysis of Merrill & Reigeluth's "elaboration model of instruction." First, the elaboration model is briefly described, with special focus on the concepts of "sequencing" and "synthesizing." Second, positive features of the theory are discussed, including the authors' emphasis on making connections between presented material and existing knowledge. Third, critical comments are provided concerning the clarity of the model, the availability of empirical support, and the failure to describe underlying theoretical mechanisms. The final section of the paper explores the relation between the elaboration model of instruction and cognitive theories of learning such as the "assimilation theory."

EDITOR'S NOTE

This paper was originally presented at a symposium on the Elaboration Theory of Instruction at the 1980 AERA Convention. The papers referred to by the author are not printed in *JID*, but the reader unfamiliar with the Theory being discussed is referred to:

Reigeluth, Charles M. "In search of a better way to organize instruction: The elaboration theory." *JID*, Spring, 1979, 3, 2, pp 8-15; and Reigeluth, Charles M. and Cathy A. Rogers. "The elaboration theory of instruction: Prescriptions for task analyses and design." *NSPI Journal*, February 1980, pp 16-25.

Introduction

In this paper, I review the "elaboration model of instruction"—an emerging instructional theory developed by David Merrill, Charles Reigeluth, and others—that is based partially on existing

cognitive theories of memory. The authors have provided the interested reader with an extensive documentation of elaboration theory. In preparing this short report I became acquainted with over a dozen documents, totaling more than 500 pages, describing elaboration theory. Thus, the job of discussing elaboration theory is aided by the fact that the authors have been willing to describe the theory in detail.

I will address four questions in turn: (1) What is elaboration theory? (2) What are the positive features of elaboration theory? (3) What features need further development? (4) How does the theory fit in with cognitive theories of human learning and memory?

Definition of Elaboration Theory

Elaboration theory has three general characteristics: (1) It is a prescriptive theory of instruction rather than a descriptive theory of learning, aimed at telling "how to" instruct rather than "how" people learn. (2) Elaboration theory is concerned with the structure and organization of material rather than the specific material itself. (3) Elaboration theory attempts to be consistent with existing research findings concerning human learning, memory, and cognition. It attempts to be consistent with cognitive psychology.

Two principle features of elaboration theory are mentioned repeatedly in the writings. First, instruction should proceed from the general to the specific. The authors refer to this issue as "sequencing." Second, each part should be related to the general context and to other parts. This issue is referred to as "synthesizing." A typical quote from the authors shows the importance of sequencing and synthesizing: "The elaboration model of instruction starts the student with a very broad, general view of the subject matter to be taught. Then it divides the subject matter into

parts, elaborates on each of those parts, divides those parts into parts, elaborates on each of those subparts, and so on until the knowledge has reached the desired level of detail and complexity."

I am particularly interested in the two ideas of sequencing and synthesizing. In describing the sequencing procedure, the authors introduce the "epitome"—a very general and brief summary of the to-be-presented content area. In some ways the epitome is like an advance organizer, because it is intended to provide a general context for all new, incoming information. The authors give the impression that generating epitomes for subject matter is a crucial step.

The description of the process of synthesizing emphasizes learning by understanding—that is, on learning by mapping new information into existing knowledge. For example, the synthesizing procedure "makes parts of subject matter more meaningful to the student by showing their context, that is by showing how they fit into a larger picture." This "fitting into a larger picture" is, then, a powerful and central idea.

The authors claim that elaboration techniques result in "meaningful learning." In various papers the elaboration theory is purported to enhance long-term retention, student enjoyment, and student motivation.

Useful Aspects of Elaboration Theory

Elaboration theory provides potentially useful distinctions and taxonomies, i.e., the distinction between sequencing and synthesizing. I agree with the authors that the creation of a general theory of instruction would be a great aid to teachers, curriculum designers, and others. The authors have attempted to base their theory on existing psychological literature.

The general principles that are the

basis for elaboration theory resonate well with our current understanding of human learning and cognition: (1) emphasis on the context of learning, (2) emphasis on elaboration or connections with cognitive structure, and (3) emphasis on "fitting into a larger picture." All of these ideas are consistent with current emphasis in cognitive psychology on the role of organization and structure, the role of rehearsal and elaborative processes, the relation between new knowledge and prior knowledge.

These general ideas are also consistent with a long history of research on the psychology of meaningful learning. Many of the general comments I read in the documents that were sent to me could have been written by a Bartlett or a Katona. For example, Bartlett's famous emphasis on "effort after meaning" is based on the idea that learning involves "connecting something that is given with something other than itself." Katona's famous distinction between learning by memorizing and learning by understanding plays on allowing the learner to build "structural relations," i.e., to see how each part fits into the larger structure.

Criticisms of Elaboration Theory

Vagueness. My first concern is the level of specificity of elaboration theory. There is a sense that the authors are working against the *zeitgeist* because they are building a general theory at a time when most psychologists have opted for building very small theories for very limited domains. Thus, although elaboration theory does define each term—such as epitome or synthesizing—it does not achieve the level of clarity and specificity that one would prefer. The ideas sound reasonable at a general level but it is hard to define such terms as "fitting into a larger picture" or "providing a general structure."

Empirical tests. A second comment concerns the need for empirical support of aspects of the theory. Many of the terms that are defined with a sense of authority, such as "general-to-detailed" sequencing or "providing epitomes," can really be thought of as empirical questions. What is an epitome? What is synthesizing? What effects do they have on learning? These empirical questions require greater attention than they have been given.

Theoretical mechanisms. Unless we

know how and why elaboration techniques work, we do not really have an elaboration *theory* or *model*, but rather an elaboration *technology*—a "how to do it" procedure. We need to know what are the cognitive mechanisms which underlie the effectiveness of the instructional techniques.

Analysis of Stimulus. Finally, there is a sense that this theory focuses more on an analysis of the stimulus than on an analysis of the learner's information processes. It seems to fit within the task analysis tradition. While task analysis has proven to be both a powerful tool and a useful tool, it would be even more effective if it focused on the learner. A theory of instruction should be based on analysis of the information processing of the learner as well as on analysis of the stimulus materials. I am suggesting that the theory focus more on the learner and what is going on in the learner's head.

In summary, my reading of the "basic" papers of elaboration theory to date suggest that the technology of elaboration is running far ahead of the science of elaboration. By this I mean that elaboration theory seems to do a better job of telling us "how to do" than of telling us "why to do." This problem can be attacked on each of the fronts I have outlined above: by being more specific (e.g., by telling what "fitting into a larger picture" means, or what defines a "general context," or what is the nature of "meaningful learning"); by providing empirical tests of the predictions of elaboration theory; by specifying the cognitive mechanisms which underlie elaboration theory; and by focusing on internal cognitive processes and states. In short, we need to know how and why elaboration techniques influence learning.

Comparison with Cognitive Learning Theories

My fourth task in this presentation is to compare the elaboration theory of instruction with existing cognitive theories of human learning, and in particular, with what has been called "assimilation theory." How are cognitive theories of instruction (such as elaboration theory) similar to cognitive theories of learning (such as assimilation theory)? Both deal with how information is acquired, stored, and retrieved by a person. Both deal with factors which influence the outcome of learning. However, the two

types of theories also differ in important ways. Elaboration theory focuses on a technology for presenting the stimulus material to achieve various desired outcome performances. Cognitive theories of learning focus on the information processes and structures which are involved in learning new information. If we view the main variables as the stimulus, the response, and the internal cognitive activity, then the present version of elaboration theory focuses on the stimulus while cognitive theories of learning focus on the internal activity.

Elaboration theory is designed to become a general theory of instruction which is consistent with cognitive theories of human learning. Many of the criticisms I raised in the previous section could be alleviated if elaboration theory was related to a correspondingly broad theory of learning. Unfortunately, cognitive psychology has not yet developed a general theory of learning. The closest we have come to developing general cognitive theories of learning are what the organizers of this symposium call "assimilation theory" and "schema theory." I will focus on what has been called "assimilation theory."

I suggest that there is no one "assimilation theory." The term has been used by Bartlett to describe learning and memory for pictures and folk stories, by Piaget to describe the process by which knowledge grows in developing humans, by Ausubel to describe expository learning from prose, by myself to describe "meaningful learning" processes that result in creative problem solving, and by many others. Unfortunately, there has not been universal agreement on what process of learning is reflected in the term "assimilation." Since the work of each of the relevant authors is readily available, I will focus my discussion of assimilation theory from my own point of view.

There are several basic ideas in an assimilation theory of learning which are most relevant for an elaboration theory of instruction. (1) Meaningful learning involves the following cognitive processes; the to-be-learned information must be received by the learner (e.g., the learner must pay attention); the learner must possess a relevant set of existing concepts which can be used to assimilate the new material (e.g., the learner must possess an assimilative set); the learner must actively use the assimilative set and integrate new information with existing

knowledge. (2) Instructional variables may influence any one or more of these processes. For example, behavioral objectives and adjunct questions may affect what incoming information the learner pays attention to; advance organizers may serve to provide an assimilative set; and discovery or student elaboration activities may serve to encourage active integration of old and new knowledge. These all are, of course, empirical questions which must continue to be tested and clarified. (3) Differences in the process of learning can result in structurally different learning outcomes even when identical information is presented. Since the outcome of learning involves both the stimulus materials and the cognitive structures to which the materials are assimilated, it is possible that some learners may use one assimilative set while others use another. In this case structurally different outcomes would result. Structural differences can be indicated not by differences in overall amount retained, but rather by differences in the pattern of transfer or the pattern of recall performance by type of information.

The foregoing brief summary of assimilation theory provides an agenda for work on elaboration theory. First, it would be useful for elaboration theorists to explicitly describe the information processing variables (such as attention, availability of the assimilative set, integration, etc.) that are affected by various elaboration techniques such as sequencing and synthesizing. Next, a description of the predicted learning outcome could be generated for cases in which the technique is or is not present. Predicted differences in learning outcomes should be measured not only in a quantitative way but also in a qualitative way. If elaboration theory allows for broader, more integrated outcomes, these should be manifested in the pattern of transfer performance and pattern of recall by type of information. To date it appears that the authors of elaboration theory have focused mainly on how much is learned rather than on what is learned under elaboration techniques. Assimilation theory provides very specific predictions concerning interactions involving the degree of transfer, the ability of the learners, and the familiarity of the material. These may also be applicable to tests of elaboration theory.

One final important link between elaboration theory and assimilation theory concerns the respective roles of epitomes and advance organizers. Much of the work on assimilation theory has involved a study of the effects of advance organizers on prose learning. In our own studies we have attempted to test the claims that concrete analogical models provide an assimilative context and encourage learners to map new information onto this context. The relation between these two ideas and elaboration theory's "sequencing" and "synthesizing" need to be explored in more detail. One major research question in assimilation theory concerns the identity of the features of a good advance organizer. Ausubel argues, for example, that an outline is not a good advance organizer. It strikes me that the definition of an epitome should be consistent with what we know about the characteristics of advance organizers, and should be tested in the same way.

Summary and Recommendations

A review of the current state of elaboration theory encourages further work toward the development of a cognitive theory of instruction. Although it is still not clear what shape that theory will take, future work should address the following recommendations:

Instructional theory should be useable. The theory should be stated with enough clarity and specificity to allow one to successfully apply the theory to a particular instructional situation.

Instructional theory should be valid. The implications of the theory should be tested in rigorous ways. Evaluation studies comparing the "treatment" and "control" groups on gross measures are not enough.

Instructional theory should be theoretical. A good instructional theory involves more than a "how-to-do-it" cookbook. It needs to explain why or how a particular instructional procedure "works."

Instructional theory should be cognitive. The useful developments in the cognitive psychology of learning and memory should be incorporated into a general theory of instruction. During the past 10 years there has been an explosion of knowledge concerning human cognitive processes and memory struc-

tures. A good theory of instruction must exploit this useful data base.

REFERENCES

- Ausubel, D.P. *Educational psychology: A cognitive view*. New York: Holt, Rinehart & Winston, 1968.
- Ausubel, D.P., Novak, J.D., & Hanesian, H. *Educational psychology: A cognitive view. (Second Edition)* New York: Holt, Rinehart & Winston, 1978.
- Mayer, R.E. Information processing variables in learning to solve problems. *Review of Educational Research*, 1975, 45, 525-541.
- Mayer, R.E. Can advance organizers influence meaningful learning? *Review of Educational Research*, 1979, 49, 371-383.
- Merrill, M.D. & Wilson, B. *Elaboration theory and cognitive psychology (Working Paper No. 127)*. San Diego: Courseware Incorporated, 1979.
- Reigeluth, C.M. In search of a better way to organize instruction: The elaboration theory. *Journal of Instructional Development*, 1979, 2, 8-15.
- Reigeluth, C.M. *Meaningfulness and instruction: Relating what is being learned to what a student knows*. Paper presented at the meeting of the American Educational Research Association, Boston, April 9, 1980.
- Reigeluth, C.M., Merrill, M.D., & Bunderson, C.V. The structure of subject matter content and its instructional design implications. *Instructional Science*, 1978, 7, 107-126.
- Reigeluth, C.M., & Merrill, M.D. *Classes of instructional variables (Working Paper No. 70)* San Diego: Courseware Incorporated, 1978.
- Reigeluth, C.M. & Merrill, M.D. *A knowledge base for improving our methods of instruction (Report No. 68)*. San Diego: Courseware Incorporated, 1978.
- Reigeluth, C.M., Merrill, M.D., & Wilson, B.G. *Final report on the structural strategy diagnostic profile project (Working Paper No. 120)*. San Diego: Courseware Incorporated, 1978.
- Reigeluth, C.M., Merrill, M.D., Wilson, B.G., & Spiller, R.T. *The elaboration theory of instruction: A model for sequencing and synthesizing instruction (Working Paper No. 104)*. San Diego: Coursework Incorporated, 1978.
- Reigeluth, C.M. & Rogers, C.A. The elaboration theory of instruction: Prescriptions for task analysis and design. *NSPI Journal*, 1980, 19(1), 16-26.