THE SEQUENCING OF INSTRUCTION AND THE CONCEPT OF ASSIMILATION-TO-SHEMA*

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ABSTRACT

The concept of assimilation-to-schema proposes that learning depends on three conditions: (1) the reception of the to-be-learned material, (2) the availability of a cognitive structure to which the new material may be assimilated, (3) the activation of the structure during learning. The concept provides weak (i.e., concerning amount of learning) and strong (i.e., concerning the structure of learning outcomes) predictions with respect to the effects of sequencing of instruction, ordering of instruction and organization of instruction. The present review demonstrates that studies of the role of instructional sequencing provide an important test of the assimilation-to-schema theory, and that many apparent inconsistencies in the literature may be better understood by an analysis of the internal assimilation process.

The Concept of Assimilation-to-Schema

The concept of assimilation-to-schema is a persistent — albeit many-faceted — theme in the history of the psychological study of human learning and memory. In its simplest form the concept refers to the processes of learning as the acquisition of new material in the learner by connecting it with (or “assimilating” it to) some aspect of existing cognitive structure (or “schema”), and the product of learning as the newly reorganized cognitive structure which integrates old and new knowledge and which, in turn, may serve as an assimilative schema for subsequent learning. Bartlett (1932, p. 172–201) was one of the first to popularize the view: “Schema refers to an active organization of past reactions or of past experiences . . . without some general setting or label, as we have repeatedly seen, no material can be either assimilated or remembered.”

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Coming from a biological orientation, Piaget's (Flavell, 1963) monumental theory of cognitive development has also relied heavily on the concepts of assimilation and schema, although they are not explicitly emphasized as components in a theory of adult learning nor are they posed in a directly testable way. More recently, much of the rebirth of interest in cognitive processes in learning (Bower, 1970; Bransford and Franks, 1971), cognitive structure of memory (Collins and Quillian, 1972; Kintsch, 1972; Rumelhart, et al., 1972), and the role of meaning in verbal learning (Martin, 1968; Johnson, 1975) may be interpreted as attempts to clarify and test Bartlett's pronouncements.

In educational psychology, Ausubel (1968) has provided an important extension of the assimilation-to-schema idea to instructional considerations. However, Ausubel's theory differs from Bartlett's in several important ways: (1) Ausubel views schemata as cognitive structures (i.e. sets of cognitive knowledge) rather than a collection of emotional or attitudinal responses, (2) Ausubel's theory emphasizes the interactive-constructive nature of the learning process rather than the process of remembering, (3) Ausubel introduces an important distinction between two types of learning processes involving either assimilation of new information to a meaningful structure of existing experiences (meaningful learning set) or to a much narrower set (rote learning set).

According to this view, a meaningful learning set requires the fulfillment of three conditions: (1) reception of the to-be-learned material, (2) availability of a meaningful structure of familiar ideas that can be used to organize and assimilate new incoming material, and (3) activation of this meaningful set during learning. On the other hand, a rote learning set requires fulfillment of only the first condition so that new information is assimilated within a much narrower or emptier existing structure. These types of assimilation-to-schema processes may be represented as points in a continuum such as shown in Fig. 1. Although Fig. 1 is adapted from an attempt to discuss prior research findings on learning statistics (Mayer, 1975a) the present paper will explore its extension to a larger domain — the sequencing of instruction.

Two testable predictions have been offered based on this version of the assimilation-to-schema theory. A "weak" prediction, suggested by Ausubel (1963, 1968) is that learning with a meaningful learning set, by providing more anchors for new incoming verbal information, should result in quantitatively more learning as measured by amount of retention. More recently, a "strong" prediction has been offered (Mayer and Greeno, 1972; Mayer, 1975b) that learning with a meaningful learning set should result in qualitatively or structurally different learning outcomes as measured by the pattern of transfer. The "strong" prediction was summarized as follows: