INFORMATION PROCESSING

Learning Theory: Information Processing

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Educators are very interested in the study of how humans learn. This is because how one learns, acquires new information, and retains previous information guides selection of long-term learning objectives and methods of effective instruction. Cognition goes far beyond simply the taking in and retrieving information. It is a broad field dedicated to the study of the mind holistically. One of the primary areas of cognition is memory. There are many hypotheses and suggestions as to how this integration occurs, and many new theories have built upon established beliefs in this area. Currently, there is widespread consensus on several aspects of information processing; however, there are many dissentions in reference to specifics on how the brain actually codes or manipulates information as it is stored in memory. Despite disagreement on many levels, there is general agreement among most cognitive psychologists on some basic principles of the information processing system. First, there is the “assumption of a limited capacity.” Depending on the theory, these limitations occur at different points in information processing, but it is widely held in all models that there are limitations as to how much and at what rate new information can be encoded, stored and retrieved (e.g., Broadbent, 1975; Case, 1978) Most cognitive psychologists also agree that there exists some type of control system for dealing with stimuli (e.g., Atkinson & Shiffrin, 1971). Again, exactly how and where the controls operate is a question of some debate, but the actuality of some type of system that requires some processing capacity is generally accepted. The belief in the interaction of new information with stored information is a third key point of cognitive study. It is that there is a two-way flow of information as we try to make sense of the world around us. We constantly use information that we gather through the senses (bottom-up processing) and information we have stored in memory
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(top-down processing) in a dynamic process as we construct meaning about our environment and our relations to it. This is in a sense comparable to the difference between inductive reasoning (going from specific instances to a general conclusion) and deductive reasoning (going from a general principle to specific examples.) A similar distinction can be made between using information we derive from the senses and that generated by our imaginations. It is usually demonstrated with the above bottom-up or top-down system or a combination of the two. Satisfactory results have been accomplished in the initial process of language instruction in my classroom through three interwoven techniques: categorizing language concepts and vocabulary, understanding the sentence structure as a whole and as parts, and manipulating rote rehearsed vocabulary within the sentence structure. Finally, there is also agreement that humans have specific genetic traits that dictate the method by which they gain new information. For example, all human infants make the same vocalizations during the first six months, regardless of the language spoken around them (Flavell, Miller, & Miller, 2002). After that, infants begin to vocalize the sounds of the mother tongue and omit sounds not found in that language (Jusczyk, 1997). It has also been discovered that infants begin to lose the ability to discriminate sounds not in the mother tongue at about six to seven months of age (Werker & Tees, 1999). All of these factors play a significant role in the development and understanding of how the mind operates, but they are only the starting point, or maybe more accurately the dividing point, for more in depth models for information processing. Traditionally, the most widely used model of information processing is the stage theory model, based on the work of Atkinson and Shiffrin (1968). The key elements of this model are that it views learning and memory as discontinuous and multi-staged. It is hypothesized that as new information is taken in, it is in some way
manipulated before it is stored. The stage theory model recognizes three types or stages of memory: sensory memory, short-term or working memory, and long-term memory. Sensory memory represents the initial stage of stimuli perception. It is associated with the senses, and there seems to be a separate section for each type of sensual perception, each with its own limitations and devices. Obviously, stimuli that are not sensed cannot be further processed and will never become part of the memory store. There are many ways to ensure transfer and many methods for facilitating that transfer. There are several suggested models of how new stimuli are recognized in sensory memory, and each deals with pattern recognition. The matching of new stimuli to existing memory structures is a crucial factor in the acquisition of new knowledge. If new information is not brought into memory in a meaningful way, it will not be stored as memory. Therefore, the understanding of the patterns by which this information is represented is critical to the proper introduction of new information. The second stage of information processing is the working or short-term memory. This stage is often viewed as active or conscious memory because it is the part of memory that is being actively processed while new information is being taken in. Short-term memory has a very limited capacity and, unrehearsed information will begin to be lost from it within 15-30 seconds if other action is not taken. There are two main ways that are effective in processing information while it is in short-term memory. Rote rehearsal is the first but less desirable of these methods. This type of rehearsal is intended only to keep information until it can be processed further. It consists of some sort of repetition of the new information, and if it is not processed further will be lost. In language teaching, there are times when this is very beneficial to students. Learners need that repetition to first be able to recognize the sounds and acquire the ability to repeat. It will then materialize into
something familiar which can be learned. If learning is to take place, new information must be transferred into long-term memory. Therefore, repetition is sufficient to produce a lasting effect. This has great relevance to instruction and teaching, for if the aim of education is learning, information must be presented in such a way that it can be incorporated into the memory structure. Long-term memory houses all previous perceptions, knowledge, and information learned by an individual, but it is not a static file system that is used only for information retrieval. Abbot (2002) suggests that long-term memory “is that more permanent store in which information can reside in a dormant state – out of mind and unused – until you fetch it back into consciousness” (p. 1). In order to incorporate new information, long-term memory must be in communication with short-term memory and must be dynamic. There are several categories of long-term memory, and there are many suggestions as to how memory units are represented in the mind. Fortunately for educators, there are many constant themes of information processing regardless of the specific theory to which one subscribes. Almost all ideas related to how information becomes stored in memory agree that the learner more deeply and meaningfully processes information that is presented in a context-rich manner. It has been demonstrated that when new information is presented within a context of knowledge that a learner possesses, he or she has background knowledge with which new information can be compared and categorized. This categorization is also a critical piece of information processing at high levels. These theories all work under the assumption that new information can most effectively be learned if the material can be matched to memory structures already in place (Winn and Snyder, 2001, p. 3). When there is a story or an argument or an idea that we want to remember, we usually try to rephrase it “in our own words.” When we witness some
event we want to remember, we make a verbal description of the event and then remember our verbalization. Upon recall we recreate the details that seem consistent with the particular verbal recoding we happen to have made. The kind of linguistic recoding that people do seems to be the very pulse of the thought process. It is more of an information manipulation than nonsense syllables have tried to express the ideas in more familiar terms. Informational concepts have already proved valuable in the study of discrimination and of language; they promise a great deal in the study of learning and memory.

According to Scruggs and Mastropieri (1992), mnemonics can be defined as a systematic procedure to enhance memory. Mnemonics have been used as a learning strategy to assist undergraduate students learn foreign language. I have been a believer in mnemonics for a very long time. I feel they help students remember basic facts about different things. They are an important part of instruction for many professionals. There are several types of mnemonics as well as empirical studies testing mnemonics as a memory strategy. One which I choose to mention is the study of acronym mnemonics quite relevant to my area of profession in the acronym world of the military. It has proved to be an effective learning strategy to engage students in rote learning. I have found this to be useful in teaching language acquisition, specifically teaching language survival skills.

The span of immediate memory imposes severe limitations on the amount of information that we are able to receive, process, and remember. By organizing the stimulus input into several dimensions and successively into a sequence or chunks, we manage to break (or at least stretch) this informational plane.
References


