THE COGNITIVE APPROACH TO INSTRUCTIONAL DESIGN[1]

According to cognitivists, there are several components of the mind, and each is involved in the learning process in certain ways. How each component of the mind works has implications for how we design instruction. The components are:

> Perception and memory stores
> Short-term memory
> Long-term memory.

Perception And Sensory Stores

Perception Is Selective. There is more stimulation in the environment than we are capable of attending to, and then encoding (internally translating) for storage in memory. Therefore, we only attend to certain things. We attend to and see/hear what we expect to see in a given situation. We attend to those things that interest us because they are either (a) related to what we already know, or (b) so novel they force us to attend to them.

Limits Of The Sensory Stores. Our sensory stores, also called sensory memories or "buffers," are capable of storing almost complete records of what we attend to. The catch is they hold those records *very briefly*. During that very brief time before the record decays, we do one of two things: (1) we note the relationships among the elements in the record and encode it into a more permanent memory; or (2) we lose the record forever.

ID Implications. The implications of the selectiveness of perception and limitations of sensory stores for instructional designers are that it is crucial to:

Get the learner to *attend to* those crucial parts of the environment you want learned (by building expectations, attention-getting, and establishing motivation and confidence)
Help the learner note *relationships* among the information quickly (by organizing the information and relating the new information to existing knowledge).

Short-term or Working Memory

---

[1] Excerpted from Foshay, W.R., Silber, K.H., & Stelnicki, M.B. (2003) *Writing Training Materials That Work*. San Francisco: Pfeiffer

Controversy. There is disagreement among cognitive psychologists about whether there is a short-term memory that is "separate and different" from long-term memory — whether the two are physically different, or whether are just conceptually different constructs.

Rehearsal. When information is passed from the sensory stores to memory, we mentally rehearse it. Simply repeating the information over and over, is called *passive rehearsal*. It does not seem to improve memory as well as rehearsing the information in a *deep and meaningful* way, by doing things like creating associations.

Limited capacity. There seems to be a limit on the amount of information we can rehearse at one time. The finding of the famous study that showed we can remember 7 +/- 2 bits of information at most, and that to remember more we have to "chunk" (or group), still apply, with some modifications of how you define a "bit" (element) or a "chunk."

Format. At this point in the learning process, the information being rehearsed is not yet organized and encoded as it will be when it is finally stored in memory. Also, there is evidence that there are separate spaces in the brain for storing and rehearsing verbal information and visual/spatial information.

ID Implications. The implications are that instructional designers need to:

Help learners use meaningful ways of rehearsing the information (using analogies and relating new information to existing knowledge)
Present the information in meaningful "chunks" of appropriate size for learners
Present the information in multiple formats (verbal, auditory, visual, etc.)
Present the information in a way that allows the learner to move quickly from rehearsal to encoding it in long-term memory.

Long Term Memory

In general theorists believe that long-term memory is organized based on context and experience. That means we encode, store and retrieve information in the way we have used knowledge in the past and expect to use it again in the future.

Memory strength. Information in memory has a characteristic called *strength*, which increases with practice. There is a *power law of learning* that governs the relationship between amount of practice and response time or error rates. (Strength = Practice to power x).

Elaboration. Elaboration means adding information to the information we are trying to learn. The more we elaborate on what we learn through processing, the better we remember it, because as we tie the new information to existing information and we create more pathways to get to the new information as we try to remember it.

Chunking. Memories are stored not as individual bits or as long strings of information, but in "chunks," with each chunk containing about seven elements.

Verbal and Visual Information. It seems we encode verbal and visual information differently in memory. We use a linear code for verbal information, and a spatial code for visual information. We remember visual information very well, especially if we can place a meaningful interpretation on the visuals.

Associations and Hierarchy. Information is organized in memory, grouped in a set of relationships or structures (e.g., hierarchically). Using such a structure makes it easier for us to remember, because there are more related pieces of information activated when we search for information.

ID Implications. The implications are that instructional designers need to:

   Build in a lot of meaningful practice into training
   Provide learners with information that elaborates on the information to be learned
   Present the information in meaningful "chunks" of appropriate size for the learners
   Present the information so it uses the abilities to remember both verbal and visual information
   Orgainize the information being presented hierarchically ~~organize the information being presented~~

Provide many associations to the information being learned
Teach learners to organize/index their memories so they have many associations, many retrieval paths, and appropriate structures (this is crucial to effective memory)
Use authentic (real-world) contexts for explanations, examples, and practice