LIVE AND LEARN

A LEARNING AND PERFORMANCE NEWSLETTER
PUBLISHED BY EFFECTPERFORMANCE, INC.

VOLUME 1, NUMBER 4 — FALL, 2004

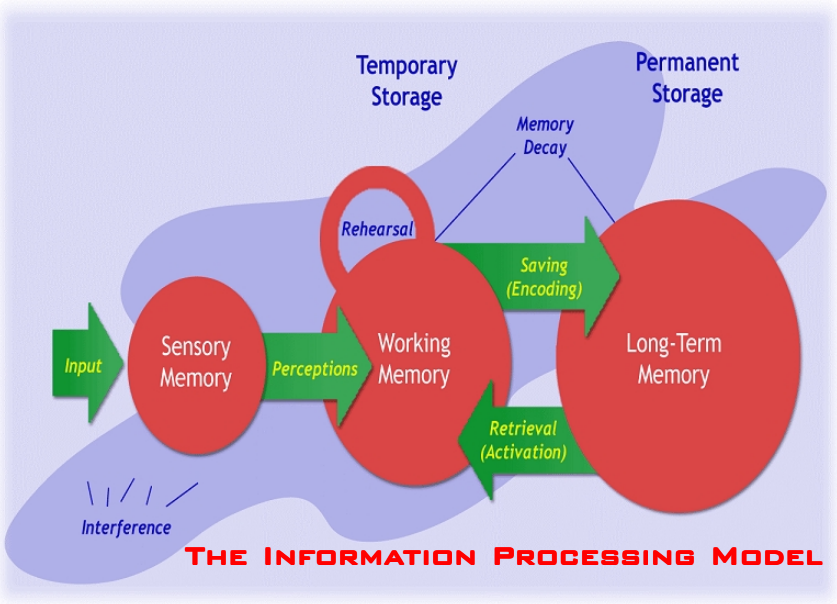
Putting Our Heads Together

Things the brain can tell us about learning

By Gus Prestera, PhD, CPT – President, effectPerformance, Inc.

You don't need to have an advanced degree in cognitive psychology to recognize that the way we train and educate workers should be rooted in our knowledge of the brain's natural processes. Within these few pages, I attempt to summarize decades of research and distill some basic truths about how training can be designed to optimize these learning processes.

Where do we start? The most relevant and commonly accepted explanations for how our brains encode, store, and retrieve information among educational researchers are Cognitive Load Theory and Schema Theory. Before we get to those, let's look at the *Information Processing Model* (see diagram).



THE INFORMATION PROCESSING MODEL

How We Process Information

Information processing begins with sights, sounds, smells, and other stimuli registering in the receptors of our sensory memory (a.k.a., sensory register). This part of the brain is able to hold vast amounts of stimuli but only for about 1 to 3 seconds. Some stimuli are ignored and lost forever; other stimuli are perceived and moved to working memory (a.k.a., short-term memory). Here we are able to focus our attention on the stimuli. Generally speaking, we can only pay attention to one demanding task at any given time.

Working memory is the brain's information processing choke point. According to Cognitive Load Theory, working memory's capacity to hold information is only 5 to 9 bits of information. When working memory is overloaded, it throws information overboard in an attempt to prevent a complete backup… memories are lost and learning slows down to a crawl. Also, there is the constant interference from irrelevant stimuli, like random thoughts that creep into your head or your cell phone going off. Another consideration is that working memory can only hold information for 20 to 30 seconds. After that, the bits are lost forever, unless one of two things happens.

Implication #1: Instructional designers need to avoid overloading working memory so that important concepts are not lost in transit. There are hundreds tactics associated

continued on page 2

In this issue:

Doc Talk

By Gus Prestera, PhD, CPT

On Sept. 30, I'll be presenting at ISPI's Instructional Systems Design Conference in Chicago. The topic: needs assessments and a set of simple tools I developed for conducting them.

The main message of my presentation is this: the "shotgun" approach to training is wasteful, ineffective, and counter-productive. While some managers pride themselves on how much training they can crank out, we know that more training is rarely the right answer. With a little analysis, you can match the right training with the right learner needs and save a lot of time, money, and credibility. Yes, credibility. If learners do not believe that you have their individual learning needs in mind, you'll lose credibility with them, resulting in more resistance to training.

The white paper, tools, and my presentation slides are available online at www.effectperformance.com.

with this need, but generally they fall into one of three strategies: (1) ***decrease*** the pace at which bits of information are communicated by chunking information into "bite-sized" pieces, (2) ***eliminate*** unnecessary information so that there are less bits to remember, or (3) ***increase*** the size of each bit by grouping related information.

Okay, back to the brain. Bits of information simply vanish from working memory unless one of two things happens. Memories can be retained through **maintenance rehearsal**, that is, by repeating something in your head over and over, like trying to remember a phone number from the moment you read it in the phone book to the time you dial it. The other way is through **elaborative rehearsal**, or elaboration. Elaboration means associating new information with something you already know. In order for this to occur, you need to activate (remember) information stored in long-term memory and somehow connect the new information to it. This is where schema theory is a helpful construct.

> "...learner needs to make some connection with prior knowledge and experience in order for it to 'stick.'"

Implication #2: Repetition alone is not an effective way to commit information to memory long-term. As soon as repetition stops, the information is lost. At some point, the learner needs to make some connection with prior knowledge and experience in order for that information to "stick."

When information moves from short-term memory to long-term memory, it's encoded, that is, it's translated into the language of the brain, indexed, and stored in a logical manner so that it can later be retrieved. At least, this is what our brains try to do. Constant distractions from outside influences and internal thoughts and emotions can interfere with this encoding process. As a result, things can be indexed incorrectly or misplaced, making them more difficult to find. For this reason, our brains do a lot of organizing and reorganizing at night while we sleep.

Implication #3: Allow people to *sleep on it*. Cramming a lot of learning into one day is less effective than spreading out the learning experiences over time.

The Way We Build Knowledge

According to Schema Theory, our brains store information in long-term memory as nodes of information that are connected by propositions to form a schema (node-proposition-node), for example, cake-is a type of-dessert. In this case, cake and dessert are connected by the proposition *is a type of*. As newborns, we make a lot of these simple associations. Over time, one schema is connected to another, and another, and so on to form a vast web of inter-related associations, concepts, rules, and procedures.

Schema creation - If a new piece of information cannot be linked to an existing schema, it quickly decays and is forgotten. If the new information *can* be associated with prior knowledge and experience, a new schema is built and attached to existing schemas. This is what we typically think of as gaining new knowledge or developing a new skill.

continued on page 4

How a Little Analysis Saved Big Bucks!

By Gus Prestera, PhD, CPT

Last year, I worked with a manager who was tasked with developing and implementing 28 new courses within six months. The courses ranged from project management to team leadership skills, forecasting and budgeting to compliance. The target audience consisted of newly promoted project managers. Approximately 200 hours of training were being planned for these poor unsuspecting people! The manager had no actual training department. Instead, she had 10 project teams, consisting of subject-matter experts (SMEs) from a wide variety of areas.

We met with the SMEs and documented the skill areas that would constitute these 28 courses. We put together a quick survey asking the target learners to rate their need for training in these areas. Within a week and a half, we had received 80% of the surveys and had compiled the results. The learners indicated that much of the planned training was unnecessary, some of it could be placed in job aids and other informational pieces, while others were indeed necessary because the audience had little experience in these areas. We relayed the results to the client and she immediately organized a team to begin cutting content from courses that might not be entirely necessary. The team was able to cut the training down to 118 hours in the first pass.

The first wave of training was rolled out with mixed results. The project teams that heeded our recommendations — cut unnecessary content, focus on the most relevant, embed content in real-life work examples, and give learners opportunities for meaningful practice and feedback – had very successful courses. The ones that did not were massacred in the course evaluations and in a later curriculum evaluation that we ran. We used this as an opportunity to teach the remaining teams a valuable lesson. Do not ignore the needs of your learners. Rather than giving them the training you feel is necessary – or that managers and SMEs feel are necessary – focus on what learners feel is relevant to them. As this issue's feature story tells us, adult learners will simply not learn material that they do not value as relevant to their needs.

> "Do not ignore the needs of your learners.... focus on what they feel is relevant to them."

In the end, we were able to reduce the content even further to approximately 80 hours of training. From 200 to 80 hours, if you multiply the differential by the number of trainees, times the dollar-value of their time, factor in coverage costs and opportunity costs… now you're talking real money! The great thing about it is that the survey took about 2 weeks to create, deliver, collect, and analyze. If you'd like to learn more about how to do something like this in your business, please contact us. You can also download our survey tool and our training needs assessment white paper at www.effectperformance.com.

Strategy:
Semantic Mapping

Since the 70s and 80s, Joseph Novak and other researchers have been applying concept mapping to education. A concept map usually consists of concepts and propositional links, e.g., [Ball] *is used to play* [Soccer]. Semantic maps are similar except that they do not necessarily need to have explicit links. Here's an example:

With one client, we're currently designing an online mapping activity in which learners click & drag icons representing deliverables in a project plan, grouping related ones and separating unrelated ones. We score the map by correlating the learner's map with an expert's map and provide feedback.

It is possible to have learners or teams generate semantic maps as a pre-test, as a practice exercise, as a note-taking strategy, or even as a post test. Instructors can also present using semantic maps.

In a study that I ran with Penn State's Dr. Roy Clariana and Dr. Andrew Peck, we found that online mapping exercises increased recall and learner satisfaction significantly.

Implication #4: Adult learning theory tells us that in order for adults to learn something new, they must perceive it as relevant to them and they must actively integrate it with prior knowledge and experience. In workplace training, an emphasis should be placed on delivering training on content that is perceived as relevant to the learner and gives the learner ample opportunity to link the new content with past experiences.

Schema accretion - If the new piece of information *matches* prior experience, the schema is simply reinforced, making it more likely to be activated in the future.

Implication #5: Practice is not just for beginners or for children. When we practice a task or reinforce knowledge through repetition, the nodes and their connections are strengthened, making them more memorable (just as a worn path is easier to hike).

Schema tuning - And if the new piece of information directly conflicts with prior knowledge and experience, the two competing schemas will produce dissonance (tension) until the conflict is resolved in some way.

Implication #6: When trying to change the learner's mind about something, it is critical that you create some cognitive dissonance. There are subtle ways of doing this that often involve placing the learner in a different role so that s/he can see life from a different (often conflicting) perspective. A rational approach, involving presenting evidence and experts, can also work in some instances. Emotional arguments are also effective. Five years ago, when my father and I were admiring my newborn son through the window at the hospital, I said to him, 'Your grandson is going to want you to be around to see him grow up… will you be there for him?' He didn't answer but that was the day he quit smoking.

With all three – schema creation, schema accretion, and schema tuning – prior knowledge and experience play a pivotal role. To learners, abstract instructional content can seem disjointed and irrelevant, because their brains are unable to find a way to incorporate the content with existing schemas.

> "We have difficulty remembering things outside of the context in which we learned them."

Memory in Context

When two events or bits of information occur in the same context, they are automatically linked in memory. Conversely, if memories do not share any contextual characteristics, no contextual link is formed, at least not automatically. We have difficulty remembering things outside of the context in which we learned them. In this respect, our brains can be somewhat rigid.

Implication #7: It is key that the learning of new ideas and skills be embedded in the context in which it will be performed, or as close as possible to it. This is the reason behind the growing use of computer-based simulations and role-based strategies. Military training can involve rote memorization and basic skills training, but ultimately the learning experience culminates in some form of live combat simulation. Being able to shoot at static targets accurately is good, for example, but it's more important for soldiers to be able to shoot accurately at moving targets under combat conditions. The practicing with static targets is simply preparation for the more contextually relevant experience. Similarly, workplace learning should culminate in realistic experiences. Often, however, they do not, and so learning and performance are not optimized.

So you want to optimize learning? Make training relevant, create opportunities for practice and feedback, and embed the learning experience in the appropriate workplace context. At least, that's what the brain is telling us.

We hope to see you at this year's ISD Conference in Chicago, Sept 30 - Oct. 2!

LIVE & LEARN Newsletter

effectPerformance

1513 Fairview Avenue
Havertown, PA 19083-4235