

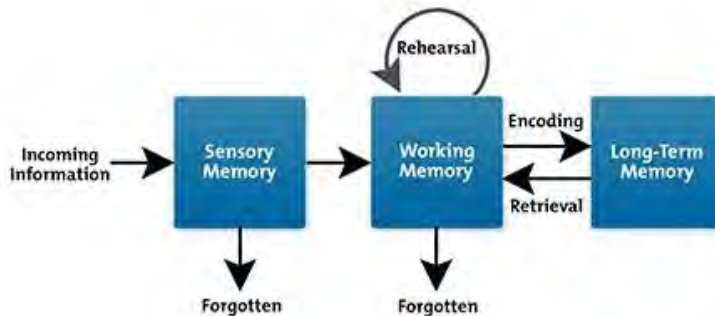
Cognitive Load Theory

A Guide to Applying Cognitive Load Theory to Your Teaching

May 2022

What is Cognitive Load Theory?

Cognitive Load Theory is based on the model of human information processing illustrated below. This model describes memory as having three main parts: sensory, working, and long-term. Sensory memory filters out most of what is going on around us, passing select information on to our working memory for additional processing.



Adapted from Atkinson, R.C. and Shiffrin, R.M. (1968). 'Human memory: A Proposed System and its Control Processes'. In Spence, K.W. and Spence, J.T. *The psychology of learning and motivation*, (Volume 2). New York: Academic Press. pp. 89–195.

Working memory can typically process 5-9 pieces, or chunks, of information at any given time. Our working memory either discards the information or categorizes it for storing in our long-term memory.

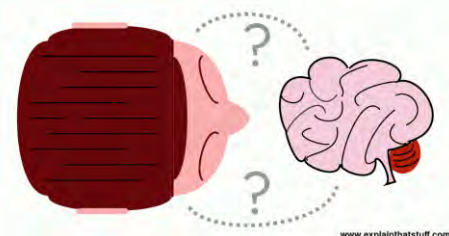
Long-term memory stores information in structures called “schemas,” which organize information based on how we use it. The more we use these schemas, the more developed they become and the easier it is to recall them.

Cognitive load refers to the amount of information our working memory can process at any given time. For educational purposes, cognitive load theory helps us to avoid overloading learners with more than they can effectively process into schemas for long-term memory storage and future recall.

How Does Cognitive Load Theory Affect Course Design?

Schemas, even highly complex ones, count as one “chunk” of information in our working memory. Activating prior knowledge or schemas allows us to focus instruction at the right level, in the gap between what our learners know and what we need them to learn.

Effective instructional design can work to reduce the “problem space,” or the gap between the current state and desired goal. If the problem space is too large, learners become overloaded and are unable to process and retain the information you are working to teach them. For example, breaking problems down into parts is easier for learners to process than trying to tackle a large, complex problem all at once.



How Do I Design Coursework Based on CLT?

The design process begins with writing strong learning objectives that provide you with an end point of where you need learners to be at the end of a session or unit of instruction. Next, assess what your learners already know or can do to so have starting and ending points for the educational process. This assessment can take many forms, from surveying or testing your students to reviewing prior curriculum.

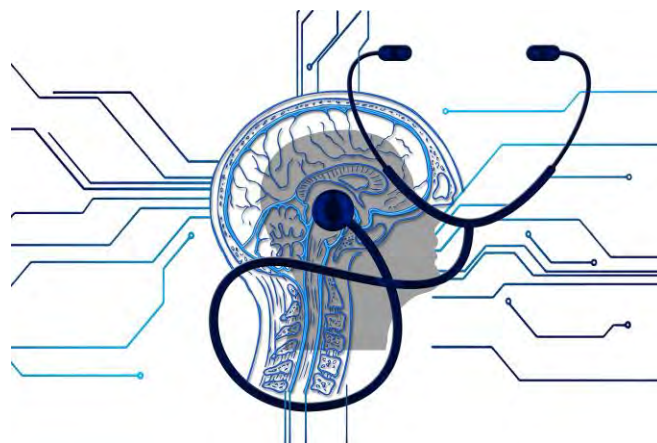


Design materials to balance visual information so it is not overwhelming to learners. For example, incorporate labels into diagrams rather than placing labels off to the side to they are most visually cohesive. This works with auditory information as well, so try to limit extraneous noise when you are presenting information verbally. If a session requires students to go 'out' and access multiple resources of information, whether it be a 3rd-party tool or database, remove the effort it takes to reach those areas. Make sure instructions with direct links, if any, are provided.

Auditory and visual information have separate working channels that do not compete with one another. Presenting information in both forms this expands the memory's ability to process the information for long-term storage and retention. Work to ensure that the information you present has both visual and auditory components.

How Can I Avoid Overloading My Learners?

There are three types of cognitive load: intrinsic, extraneous, and germane. Intrinsic load refers to the inherent difficulty in processing information, regardless of how it is presented. Intrinsic load remains constant regardless of the influence of extraneous and germane load. Extraneous load refers to the way information is presented and how easy or difficult it is for a given learner to process it. Extrinsic load will vary by person. Germane load refers to the effort needed to use memory and intelligence to process information into schemas. Germane load is thus how we process new information into long-term memory.



Cognitive overload occurs when the combination of intrinsic, extraneous, and germane loads becomes overwhelming for the learner. Even the most intelligent person can only process so much information at once. When someone is overwhelmed, they may struggle to process new information or make appropriate decisions. They may fail at a task that should be manageable given their knowledge and experience.

Cognitive overload can be addressed in a few different ways. First, ask questions of the learner to ascertain where their knowledge level is to ensure you are not teaching at an inappropriate level. Second, work to eliminate extraneous distractions, such as cell phones or other devices that may be overstimulating the learner. Third, try to focus the learner on one piece of information or task at a time. Consider the amount of time that you can give learners for the task. Being clear about how long something may take can help reduce the overload (think of a time estimate for reading materials).