Science of Learning Concepts

Classroom Teacher Pedagogy Standards EC–12 Learning Series

Cognitive Load Theory

John Sweller's **Cognitive Load Theory (CLT)** explains how the human brain processes information and the impact of cognitive load on learning.

CLT includes three types of cognitive load:

1. **Intrinsic load** – related to the complexity of the material,
2. **Extraneous load** – caused by the way information is presented, and
3. **Germane load** – refers to the mental effort required to create schemas.

Effective instructional design aims to minimize extraneous load and optimize germane load to enhance learning.

Related to the models of memory discussed earlier, working memory has exceptionally limited capacity and can be overloaded for any number of reasons. The material being studied may be too complex for the learner (intrinsic), may be poorly presented (extraneous), or there may be inadequate support for connecting to prior knowledge to support schema-building (germane).

Element interactivity is a key understanding of CLT to consider when developing learning tasks. The more complex a concept or task is, the more interconnected schemas are needed to understand it. High element interactivity means learners need to simultaneously process many interconnected elements, while lower interactivity means elements can be processed individually.

Based on the element interactivity of a concept or task, **cognitive overload** occurs when the working memory resources needed to process a task are greater than available working memory resources.

Design Considerations

- The capacity constraints of working memory must be considered in the pacing and segmenting of lesson design.
- The unlimited capacity of LTM and its role in integrating with new information in WM is a key reason why students need to practice and memorize key facts and concepts to fluency. The idea that "students can just look it up" is not aligned with what we know about how the mind works. **The foundation of higher order thinking is knowledge.**

Science of Learning Concepts

Classroom Teacher Pedagogy Standards EC–12 Learning Series