

DOCUMENT SUMMARY

This document provides a detailed overview of Cognitive Load Theory (CLT) and the Cognitive Theory of Multimedia Learning (CTML), explaining how the human brain processes information through a capacity-limited working memory. This is critically important for Enlitens as it offers a scientific framework for critiquing standardized tests, which often create high extraneous cognitive load through poor design (e.g., confusing language, irrelevant information), thereby inaccurately measuring a person's abilities. Conversely, the principles support the Enlitens Interview model, which is adaptive and can actively manage cognitive load, making it a more valid and humane method for assessing individuals, especially neurodivergent clients with differences in working memory capacity.

FILENAME

Poston_L_Cognitive_Load_Theory_critique_of_assessment_design

METADATA

- **Primary Category:** ASSESSMENT
- **Document Type:** critique
- **Relevance:** Core
- **Key Topics:** cognitive_load_theory, working_memory, instructional_design, assessment_bias, neurodiversity, multimedia_learning
- **Tags:** #CognitiveLoad #WorkingMemory #InstructionalDesign #AssessmentDesign #ExtraneousLoad #CoherencePrinciple #SignalingPrinciple #RedundancyPrinciple #Neurodiversity

CRITICAL QUOTES FOR ENLITENS

- "Cognitive load describes the total amount of mental energy that is required to process new information with the rate-limiting step being working memory".
- "Working memory has both a size limitation, about seven chunks of information, as well as a memory span limitation, 20 seconds without rehearsal, so it serves as a rate-limiting step".
- "The coherence principle states that people learn more deeply from multimedia when extraneous material is excluded".
- "It is tempting to include stories, videos, and random facts that would be interesting to the learner, but not necessary to understand the content. This extraneous information increases extraneous cognitive load, decreases available energy for essential processing, and can be confusing to the learner".
- "The detrimental effect of adding extraneous information is even more significant in learners with low working memory capacity, the cognitive load imposed by the task, the

interest level of the task, or when the content is presented using a systems-based method instead of a learner-based method".

- "Signaling seems to have a more substantial impact on low skill learners than on high skill learners".
- "On the other hand, if the learner has plenty of preexisting beliefs and perceptions, it may be much more difficult to get them to challenge these beliefs".

KEY STATISTICS & EVIDENCE

- Working memory has a size limitation of about seven chunks of information.
- Working memory has a time limitation of about 20 seconds without rehearsal.

METHODOLOGY DESCRIPTIONS

This document is an explanatory article summarizing existing theories and does not contain a research methodology.

THEORETICAL FRAMEWORKS

The document details two major, interrelated theoretical frameworks: Cognitive Load Theory (CLT) and the Cognitive Theory of Multimedia Learning (CTML).

Cognitive Load Theory (CLT)

CLT explains how new information is processed and stored.

- **Knowledge Types:** Knowledge is divided into biologically primary knowledge (acquired easily, like spoken language) and biologically secondary knowledge (requires effort, like reading to learn). The goal of instruction is to help people acquire and organize secondary knowledge.
- **Cognitive Architecture Principles:**
 - **Information Store Principle:** Long-term memory can store an almost unlimited amount of information. Learning alters the secondary data stored in long-term memory.
 - **Borrowing and Reorganizing Principle:** We acquire most secondary knowledge from other people (listening, reading, imitating) rather than discovering it ourselves.
 - **Randomness as Genesis Principle:** Without guidance, a learner must resort to randomly choosing and testing options to learn.
 - **Narrow Limits of Change Principle:** Working memory's severe limitations on capacity (size) and duration (time) prevent overwhelming changes to long-term memory, which could render it unusable.
 - **Environmental Organizing and Linking Principle:** Information from long-term memory is not subject to the same limitations as new information entering working memory from the senses.

- **Three Types of Cognitive Load:**
 - **Intrinsic Cognitive Load:** The inherent difficulty of the material itself.
 - **Extraneous Cognitive Load:** Load generated by how the information is presented; it does not contribute to learning and should be minimized.
 - **Germane or Generative Cognitive Load:** The effort used for processing, organizing, and storing information into schemas (the "good" load).

Cognitive Theory of Multimedia Learning (CTML)

CTML builds on CLT and applies it to situations where learning occurs from words and pictures.

- **Assumptions of CTML:**
 - **Dual Channels:** Humans process information through two separate channels: one for visual/spatial material and one for auditory/verbal material.
 - **Limited Capacity:** Each channel has a limited processing capacity. Executive functions in the brain allocate these limited resources.
 - **Active Processing:** Meaningful learning is an active process that requires selecting relevant information, organizing it into mental models, and integrating it with prior knowledge from long-term memory.

POPULATION-SPECIFIC FINDINGS

The document specifies how cognitive load principles affect learners with different characteristics, which is highly relevant to assessing neurodivergent populations.

- **Learners with Low Working Memory Capacity:** "The detrimental effect of adding extraneous information is even more significant in learners with low working memory capacity, the cognitive load imposed by the task, the interest level of the task, or when the content is presented using a systems-based method instead of a learner-based method".
- **Low-Skill vs. High-Skill Learners:**
 - Signaling (cueing) has a more substantial impact on low-skill learners than on high-skill learners.
 - Signaling is most effective when used with learners who have less background knowledge.
 - Novice learners tend to focus on the most salient (but not necessarily most relevant) features, while learners with more knowledge look longer at the relevant aspects of a task.

PRACTICAL APPLICATIONS

The document provides several principles and methods that can be used to design better assessments by managing cognitive load.

Methods to Reduce Extraneous Cognitive Load

- **Coherence Principle:** "The coherence principle states that people learn more deeply from multimedia when extraneous material is excluded". Adding interesting but unnecessary stories, videos, or facts increases extraneous cognitive load and can confuse the learner.
- **Redundancy Principle:** "The redundancy principle states that people learn more deeply when they have graphics and narration rather than graphics narrative and on-screen text". Presenting identical information as on-screen text and narration simultaneously overloads the visual channel and interferes with learning. However, redundancy can be beneficial for non-native speakers, learners with hearing disabilities, or when technical terms are used.
- **Signaling Principle:** "The signaling principle states that people learn more deeply when cues are added that highlight the organization of the essential material or to help them select the most relevant information". Cues can be textual (bolding, underlining), visual (arrows, highlights), or auditory (vocal emphasis). Signaling helps learners select the correct information to process in working memory.

Using Refutation Text to Facilitate Conceptual Change

This method is applicable to helping clients reframe their understanding of their own neurotype.

- **The Challenge:** If a learner has strongly held preexisting beliefs, it is difficult to get them to challenge those beliefs, a process called accommodation.
- **Conditions for Change:** For successful accommodation, the learner must be dissatisfied with their current understanding, and the new explanation must be fruitful in explaining inconsistencies.
- **Refutation Text:** This is a method to facilitate change. It is structured to:
 1. State the common misconception directly.
 2. Explicitly state that the misconception is not valid.
 3. Provide a refutation of the misunderstanding along with the correct scientific explanation.