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Cognitive Load Theory: Helping Students' Learning Systems Function More Efficiently

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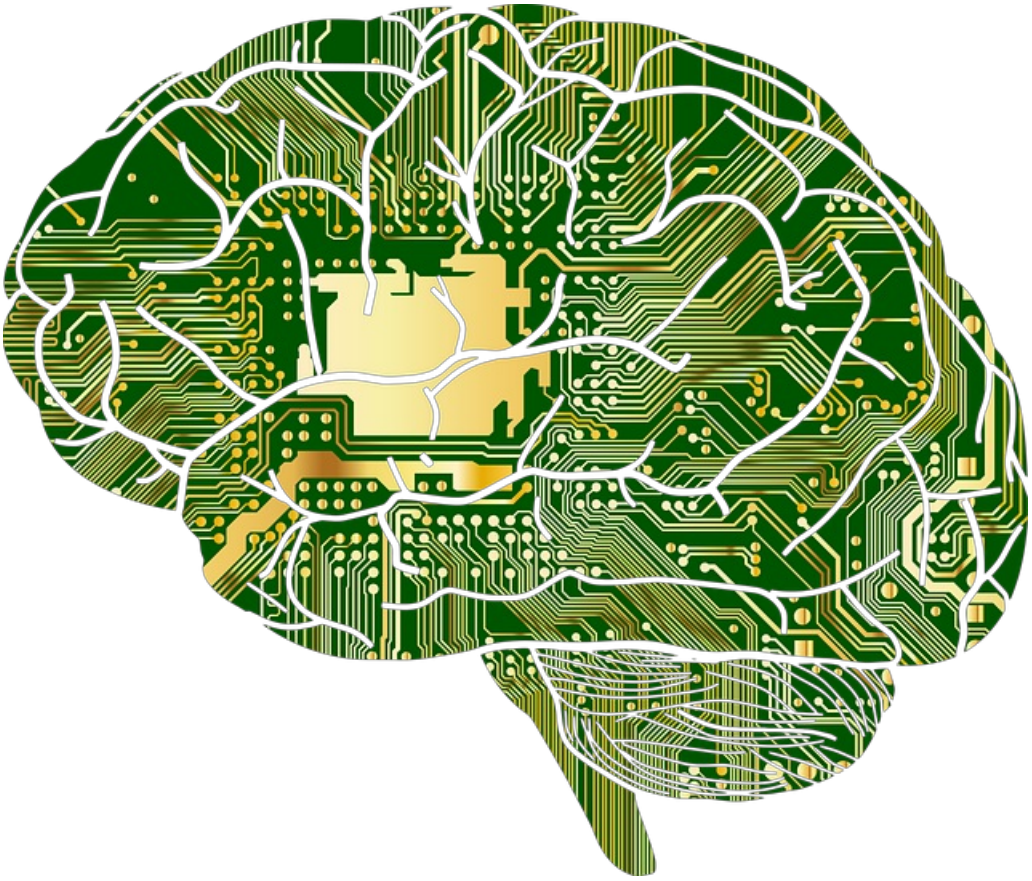

Cognitive Load Theory: Helping Students' Learning Systems Function More Efficiently

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Cognitive load is the amount of working memory being used, like the RAM in your computer, only for the human brain. When memory usage on your computer is high, the system starts to slow down; it doesn't function as efficiently. The same thing happens with learning. When the cognitive load is high, learning is less efficient.

Cognitive load is divided into three types, each with its own challenges for instructional designers.

1. Intrinsic load. This is often described as the inherent difficulty of the subject matter. Think of it as the RAM requirement for a piece of software, like a web-browser or a word processor. It is generally considered fixed; an instructional designer cannot change the intrinsic load.

Strategies for dealing with intrinsic load. While the difficulty of a subject cannot really be changed, certain practices can help reduce this load, such as the following:

- **Sequencing**: presenting parts of a concept in sequence can reduce the intrinsic load of the whole (van Merriënboer, Kester, & Paas, 2006). However, this only works with certain types of content **Chunking**: breaking content down into smaller yet still meaningful units can help reduce this load. However, care must be taken that when chunking the content, you aren't removing the meaningful connections between the chunks. Doing this can reduce the germane load (Ayres 2006).

2. Germane load. This is the portion of the memory devoted to integrating new information, the creation and modification of schema (Sweller, van Merriënboer, & Paas, 1998). Germane load is similar to the memory usage of your computer while it's actually installing your programs. Instructional design strategies should increase this type of load, as this will help increase the amount of memory devoted to integrating new information into your learner's systems. The more memory you can devote, the more efficiently you can install the content.

Strategies for increasing germane load. Strategies for increasing the germane load are the strategies that instructional design really focuses on (Hultberg, 2017). They often require more care in implementation than strategies for dealing with extraneous load (see below) given that some strategies may have opposing effects with different groups of learners. For example, de Jong (2010) notes that strategies that increase germane load for experts can increase

extraneous load for novices. However, there are general strategies that can be used broadly to increase germane load, which are as follows:

- **Reflection**: reflecting on a concept and connecting new content with past experiences can assist with the creation of more complex schemas.
- **Interleaving**: presenting similar but distinct concepts, terms, or principles together can assist with discrimination learning and thereby avoid the construction of incorrect schemas (Rohrer, 2012).
- **Worked Examples**: providing explanations with solutions can help with the creation of schema, particularly with novice leaners.

3. Extraneous load. This is the portion of memory that is taken up by processes not related to learning at all. This is equivalent to the memory used by all the hidden programs running in the background in your system tray. Instructional design strategies should aim to reduce extraneous load as much as possible. We need to free up memory by closing programs we aren't using so that the memory can be used to install new learning as efficiently as possible.

Strategies for reducing extraneous load. The most important factors to keep in mind when trying to reduce extraneous load are avoiding split attention and redundancy (Yeung, Jin, & Sweller, 1997). The bulk of CLT research has been in this area. To avoid redundancy, I present strategies below that are more technical in nature as they are less often looked at from a CLT perspective than curriculum-related strategies.

- **Keep students in the LMS when possible**. One great way of reducing split attention is by keeping your students in the LMS instead of sending them out to view content. One big culprit here is linking to YouTube. YouTube pages are full of distractions. You can reduce this by either embedding the YouTube video in the LMS (if your system allows this) or by linking to the URL in the embed code. Using the URL in the embed code opens the video fullscreen automatically, removing the other distractions on the page. Also, be sure the URL include the *?rel=0* string, so that the video doesn't show suggested videos when it ends.
- **Set links to open in a new tab**. When you do have to send students out for external content, it is best to set the link to open in a new tab. This way, if learners close the tab, they don't lose where they are in the LMS. Additionally, using the back button to go from an external site to a location inside an LMS doesn't always work properly, which can lead to a learner to losing their location and any unsaved content.
- **Keep the course navigation clean and simple**. It is important to provide your learners with all the information necessary to successfully complete the learning objectives. However, this needs to be organized in a logical way that doesn't cause confusion or stress. For example, links to policies and procedures should all be in one place, so learners don't have to go to multiple locations looking for answers to questions they might have. If you need to reference a policy, link to it rather than duplicating it.

By being aware of the three types of cognitive loads, as well as the strategies for reducing these loads, instructional designers can set their learners up for successful, efficient learning.

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About the Author

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Jesse Fuhrman earned his Master of Arts in Technologies of Instruction and Media from The Ohio State University.