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Cognitive load theory and its application in the classroom

Posted December 6, 2017By Blake Harvard@effortfuledukrWhat's Cognitive Load Theory? It's a shame, really. Teachers around the world spend large sums of money on higher education. They spend a large amount of time commit to writing documents, lesson plans, learning how to write reliable/valid assessments, discovering educational law, etc. But I'm not aware of educational programs that emphasize how we learn. How does the brain remember that? What are its potential limitations? The main goal of the school is to remember information in order to change behavior. It seems likely to me that this would help educators and students better achieve this goal if everyone involved really knew how our memory works. In addition, after discovering the features and limitations of our memory, how can we use this in the classroom to optimize material retention? One theory describing this is cognitive load theory (CLT). Pedagogical psychologist John Sweller is appreciated for this theory, which appeared in the 1980s. To understand CLT, one must have an understanding of how the brain learns/remembers. After encoding new material, the information is stored for a very short period of time in our working memory. The amount of information that may be stored in our working memory at a given time is limited and may vary from person to person. Information that persists outside of working memory is stored in long-term memory. CLT assumes that we store information in long-term memory as schemas that organize it and allow for more efficient storage and easier loading. One of our primary goals as educators is to help students meet new information in a way that allows them to transfer it to a long-term memory where access is needed. One important way to support this goal is to manage cognitive stress in our classrooms and in our lessons. [Picture: Public Domain] Schemas are also important in reducing cognitive load in our working memory. For example, if asked for the colors of the rainbow, many would recall mnemonics, ROY G. BIV, from their basic scientific classes. Remembering this shortcut allows our working memory to remember and retrieve a reduced load of information. The alternative would ask your working memory to either store or load red, orange, yellow, green, blue, indigo, and purple separately. Retrieving working memory with seven unrelated bits of information is very likely to cause overloading. However, remembering ROY G. BIV represents only one scheme and drastically reduces the cognitive load on information about our working memory. Specifically, there are three types of cognitive load. They are additive, so all three must be taken into account when considering overall cognitive load.1. Internal load - the complexity of the information and experience of the student. This is the required burden of remembering/learning.2. Foreign load - unnecessary learning burden. It does not contribute to the preservation of material and instructional procedures that minimize or maximize foreign loads.3. Germane load - a good load when learning. The necessary load on the working memory arms to create schemas and transfer material to long-term memory. If we discuss the Piaget phase of cognitive development in my class, the student's previous knowledge of Piaget and/or cognition represents the internal burden of the present. The instructional methods used may represent a foreign load. For example, a complex learning strategy using student collaboration activities can create a foreign load because some working memory capacity must be used to remember activity steps. It is not useful for remembering the Piaget phase of cognitive development, but requires cognition and inhibits working memory capacity. As the actual material is remembered, there is a germane load. If students create a diagram for the sensorimotor phase because it contains the word sensory and visualizes the five senses, their working memory carries the necessary memory load (germane load). [Picture: EDUC320neeb, CC BY-SA 4.0] Cognitive load theory most directly supports an explicit model for teaching. In general, teachers using explicit teaching believe that new material should be presented directly in a way that aims to teach scaffolding. By starting with the simplest information and then building on it, the student's working memory is allowed to create simple schemas and gradually add to them, creating more complex schemas. This model of teaching reduces foreign loads; thus reducing the overall cognitive load and increasing material retention and potential processing into long-term memory. How can I use cognitive load theory in my class? A little background on my class - I teach AP psychology this semester on the ninety-10th, 11th, and 12th. Anywhere between 80-90% of the total school population will attend either 2 years or 4 years of college/university after graduation. I can only assume (dangerous, I know) this percentage equals or higher within my student population because it is an advanced placement class. Given this high percentage of students attending higher education institutions, I believe it is essential that my students learn strategies that show evidence of increased material retention. In addition to modeling and practicing these strategies, I also discuss how they can take advantage of our working memory limitations and, when used correctly, help reduce foreign loads while maximizing material retention. When I think about how I want to present material to my students, two questions come to mind:1. How can I best present this information (a) for inclusion in existing schemes? (b) for proper new schemes?2. How can I best reduce foreign load when presenting material? These questions really drive how I build the presentation material in my classroom. In addition to hearing about Sigmund Freud (never mind that they don't really know what he did), students enter my class with very little knowledge of psychology. With this in mind, I understand that their working memory will be 'loaded' with new information, so the presentation method is key. Also, the design of the class is also very important. Distractions are just that; space in the working memory and distract from the relevant information. An environment in the classroom that lacks such distractions does not burden cognitive stress. Below are many different aspects of the lesson or classroom environment that are important to consider when taking into account the theory of cognitive load: Table arrangementsAlthiing is very popular in education, offering flexible sitting or sitting that promotes grouping collaboration, which can actually increase foreign burdens. I prefer, especially when introducing a new topic where I know cognitive load will be tested, my seats to be placed in rows; all students face the board. This helps to cut out the distractions that can be caused by the need to turn around for the teaching or distractions that come with students against each other. This is not the most original class layout, but when embarking on a new topic with a higher internal load, this arrangement helps to reduce the foreign burden on my students so that they can devote as much of their working memory to the topic at hand. [Picture: Public Domain] TechnologyThat's not a bad thing about technology, but studies have shown that students remember more when they manually write their notes and when they avoid the distractions of social media smartphones, tablets and laptops. With this in mind, I ask my students to use only their devices if it adds to their understanding or helps them with the prescribed task/material. Presentation materialWhen using Google Slides or PowerPoint to present information to my students, I make a point to create slides that are quite simple and clean. Images should consist only of images that directly assist in explaining the material. Fun images that make a snapshot 'pretty' are not necessary and can actually hinder the processing of information. Only the necessary text must be submitted. Also, the use of easy-to-understand vocabulary on slides, outside the necessary vocabulary, helps to increase understanding of the material and reduce foreign loads. When you present a presentation, repeating a text word from the word slide also creates an unnecessary load on the student's working memory. Try to use words that help with clarification and present specific examples that will help you with assimilation and adaptation of existing schemes. Class workStudent in the classroom should be used only as a method to strengthen / review or expand on the topic. Common activities should not be used as a method of initial presentation of class information. During these activities, the working memory will be used to process the rules or many other possible distractions that accompany the group work. These unnecessary loads only reduce the available working memory needed to satisfy the internal and German storage loads. The home life of students also brings many distractions. I encourage my students to try to create an environment with as few distractions as possible; put down your phone, turn off tv and music, etc. Again, the removal of unnecessary distractors aims to reduce the foreign load on the student's working memory. I assign homework that evaluates and reinforces class information and never use homework to introduce new information. Getting information for homework that students have already encoded/processed during lessons requires less burden and is working to strengthen existing schemes. This cosmic practice of material has been shown to strengthen material retention. The above examples are just a few ways I incorporate cognitive load theory into my class. Create an environment that benefits from known limitations of working memory only benefits the student. I believe that all students, teachers and parents should have knowledge of the theory of cognitive stress. If students knew why and how their use of social media, TELEVISION, and music actually worked to reduce studio productivity, they might choose wiser learning habits. Our classrooms would also be more efficient, and perhaps students would be less abominable to classroom work and homework if they knew that their time was being used as efficiently as possible for material retention. BioBlake Harvard is an AP psychology teacher at James Clemens High School in Madison, Alabama. He has been teaching for about ten years and has earned M. Ed. and B.S. degrees from the University of Montevall. Blake has a special affinity for all things knowledge and psychology; especially if these areas are also related to education and learning. He started his blog Effort Educator to draw attention to research being done on learning, memory, and cognition and connecting them to the classroom. Another resourceusable resource that extends the theory of cognitive load and its application in the classroom is Cognitive Load Theory: Research that teachers really need to understand through the Center for Education Statistics and Evaluation. Guest.

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