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CAN WE REALLY DO MORE WITH LESS?

- SUMMARY –

This presentation deals with the question of how we can accomplish more with less in a classroom having in mind the cognitive load of a learner, and how we can optimize the load in foreign language training.

Cognitive Theory is more related to understanding how people can **process** and **store** information. To improve the intellectual performance of the students, one must think about how to use a format of instruction to help reduce cognitive load to achieve the meaningful learning outcomes that we all strive for.

Cognitive load is referred to as the amount of information that our **working memory capacity** can hold at one time.

Cognitive Load Theory (CLT) is an **instructional design theory** researched and developed by John Sweller, an Australian educational psychologist. It has become an important point of reference for researchers, instructional designers and teachers around the world. Sweller argues that human memory has a **limited capacity**; therefore, instructional procedures need to avoid overloading it with those activities that do not directly enhance learning.

The human brain can only process a small amount of new information, but can process large amounts of stored information.

Cognitive Load Theory (CLT) explains how information is transferred to long-term memory. Understanding this process enables us to identify small changes that will improve how quickly and effectively we can learn new information. Students, teachers, and families can use cognitive load theory to create environments where teaching, learning, and revision can occur more effectively.

The CLT states that we should take away any unnecessary pressure from the short-term memory, leaving it more able to focus on the information that needs to move into the long-term memory.

If we want to remember the information to use in the future, it must be moved into our long-term memory. This is where information is filed, ready for us to retrieve when we need it. New information is linked with previous learning from related topics to help us retrieve it more effectively in the future. There seems to be no limit to the capacity of our long-term memory. The challenge lies in transferring the information to there from our short-term memory and then storing it in a way that makes it possible for us to retrieve it later.

The **Cognitive Theory** has identified the following three different forms of **cognitive load**:

a) Intrinsic Load relates to the **inherent difficulty** of the learning task/subject matter being learnt, which mostly occur due to the **prior knowledge** of the topic. Intrinsic load can be described as the "necessary" type of cognitive load. Two factors influence intrinsic load – the complexity of material, and the prior knowledge of the learner. E.g the subject matter that is difficult for a beginner may be easier for an expert. **Sweller et al** believed that the intrinsic cognitive load can be reduced by altering instructional techniques that make complex materiel easier to learn – 1) the 'simple-to-complex' approach, the 'part-whole' approach (introducing individual elements of the material first), introduce materiel in its full complexity from the beginning but then to direct attention of the learner to the individual interacting elements. **For example,** a reader's mental workload can be reduced by using more plain and legible handwriting, rather than using a cursive, scribbly font.

b) Extraneous Load refers to how the subject matter is taught, which does not help in the **learning process. The extraneous load** can be increased or reduced based on several factors – the type of task, whether or not the student has difficulties with attention, attentional demands for a task, etc. An example of **Extraneous Memory Load** is a situation where someone is trying to study but is disturbed by loud music or nearby traffic. These noises are considered **extraneous load** as they act as obstacles to the completion of cognitive tasks.

c) Germane Load refers to the load imposed on the working memory by the process of learning, the process of transferring information into the long-term memory through schema construction. This can influence the learning enhancing it. It is a positive load, a load where metacognitive strategies come into play, where students are aware of their thinking processes and able to adapt new information accordingly.

As a teacher, you want to reduce irrelevant load, increase relevant load and manage/optimize intrinsic load.

The application of the CLT model to the ELT classroom can be extremely useful in determining and implementing the most effective strategies for facilitating brain-friendly learning.

STRATEGIES TO OPTIMIZE COGNITIVE LOAD:

1) Tailor lessons according to students' existing knowledge and skill

How complex is this lesson likely to be for my students? • How many pieces of information need to be understood at once? • What do my students already know?

Students learn best when teachers tailor lessons to their existing knowledge and skill. One of the most important implications of cognitive load theory for teaching practice is the need to optimize students' cognitive load, by striking the right balance between too much and too little load. To do this effectively, teachers need to have a strong understanding of where students are in their learning.

2) Use worked examples to teach students new content or skills

‘A worked example is a step-by-step demonstration of how to perform a task or how to solve a problem’.

The ‘worked example effect’ is the widely replicated finding that beginners who are given worked examples to study perform better on subsequent tests than learners who are required to solve the equivalent problems themselves (Carroll 1994; Cooper & Sweller 1987; Sweller & Cooper 1985). The reason for this, according to cognitive load theory, is that unguided problem-solving places a heavy burden on working memory, inhibiting the ability of the learner to transfer the information into their long-term memory. The learner may effectively solve the problem, but because their working memory was overloaded they may not recognise and remember the rule that would allow them to quickly solve the same problem again in the future.

3) Gradually increase independent problem-solving as students become more proficient

‘Expertise reversal effect’

The ‘expertise reversal effect’ is an important exception to the worked example effect. According to the expertise reversal effect, the heavy use of worked examples becomes less and less effective as learners’ expertise increases, eventually becoming redundant or even counter-productive to learning outcomes (Leslie et al. 2012; Pachman, Sweller & Kalyuga 2013; Yeung, Jin & Sweller 1998). This means that some instructional procedures such as worked examples, which assist learning for novices because they reduce cognitive load, are not effective for teaching more expert learners. While cognitive load theory supports fully guided instruction for novice learners, it also supports the gradual incorporation of more independent problem-solving tasks as learners gain expertise

4) Cut out inessential information

Students do not learn effectively when their limited working memory is directed to unnecessary or redundant information. The ‘redundancy effect’ occurs when learners are presented with additional information that is not directly relevant to learning, or with the same information in multiple forms. An example is a textbook which includes both text and a diagram that needlessly repeat information, or a PowerPoint presentation in which the presenter reads the text presented on the screen. Requiring learners to process redundant information inhibits learning because it overloads working memory. Cognitive load research shows that best practice is to remove redundant information from learning material.

5) Present all the essential information together

The ‘split attention effect’ occurs when learners are required to process two or more sources of information simultaneously in order to understand the material. According to Cognitive Psychology experts, this effect can be reduced by altering the instructional conditions such as incorporating

labels into diagrams or by focusing on any single item in the visual stimuli or visual instructional design in a sequential manner.

6) Simplify complex information by presenting it both orally and visually

It is also possible to decrease extraneous load on working memory by using more than one mode of communication – both visual and auditory. Evidence suggests that working memory can be subdivided into auditory and visual streams (Baddeley 1983, 2002; Baddeley & Hitch 1974), so presenting information using both auditory and visual working memory can increase working memory capacity (Penney 1989). For example, when using a diagram and text to explain a concept, the written text can be communicated in spoken form. Using both auditory and visual channels increases the capacity of working memory, and facilitates more effective learning (Jeung, Chandler & Sweller 1997; Mousavi, Low & Sweller 1995; Tindall-Ford, Chandler & Sweller 1997).

7) Encourage students to visualize concepts and procedures that they have learnt

Encouraging students to visualize what they have learnt helps them to better understand and recall the information. This strategy should only be used once students are familiar with the content, as visualizing imposes quite a heavy cognitive load. The process of visualizing means mentally reproducing a procedure or concept. When students have to visualize something they have learnt, they are required to retrieve information held in their long-term memory and process it in their working memory. This mental process helps students to engage with information more deeply, and to begin to recall it automatically without much conscious effort.

Cognitive load theory states that people (kids and adults alike) learn best under optimal conditions with learning tasks that suit them, their learning style, and the application of the information. The goal is to think about how much information is too much, and what conditions do not work well for learning new information.

The three main recommendations that come from cognitive load theory are: present material that aligns with the prior knowledge of the learner (intrinsic load), avoid non-essential and confusing information (extraneous load), and stimulate processes that lead to conceptually rich and deep knowledge (germane load). These design principles have been around in educational design for a long time.

Regardless of one's education philosophy, in my humble opinion, all teachers need to have an awareness of the potential benefits and limitations of the ways in which they present learning opportunities for learners. CLT and the associated empirical research provides us with an understanding of how we process, organize and store information most effectively, and for this reason, all of us should acquire a basic understanding of the premise.