Cognitive Load Theory

Avoiding overloading 'working' memory...

What is Cognitive Load Theory?

Cognitive Load Theory (CLT) has recently become the next 'the big thing' in teaching. Dylan William (2017), states that he *'has come to the conclusion Sweller's Cognitive Load Theory is the single most important thing for teachers to know'.* In the first of our T&L spotlight papers I would like to present a little of the background research and offer an insight into practical teaching and learning approaches based on the considerations of this theory.

Cognitive Load Theory, first researched by John Sweller (1998), is based around the idea that our working memory (the equivalent of short-term memory) – the part of our mind that processes what we are currently doing – can only deal with a limited amount of information at one time. The theory identifies three different forms of cognitive load:

- **Intrinsic cognitive load**: the inherent difficulty of the material itself, which can be influenced by prior knowledge on the topic.
- **Extraneous cognitive load**: the load generated by the way material is presented and which does not aid learning.
- **Germane cognitive load**: refers to the construction, processing and automation of schemas.

CLT suggests that if the cognitive load exceeds our processing capacity, we will struggle to complete the activity successfully. Working memory should be seen as ***short term*** and ***finite***. Imagine an A4 sheet of paper and disappearing ink – the information that will fit on the piece of paper is limited and the writing will disappear over time. The long-term memory can be seen as long term and infinite. Once information is in the long-term memory it can theoretically remain there forever, and no-one has ever run out of space. The aim for us, as teachers, should be to move knowledge to long-term memory because when a student is exposed to new material they can draw on this previous knowledge and the cognitive overload is reduced.

How do we reduce cognitive load?

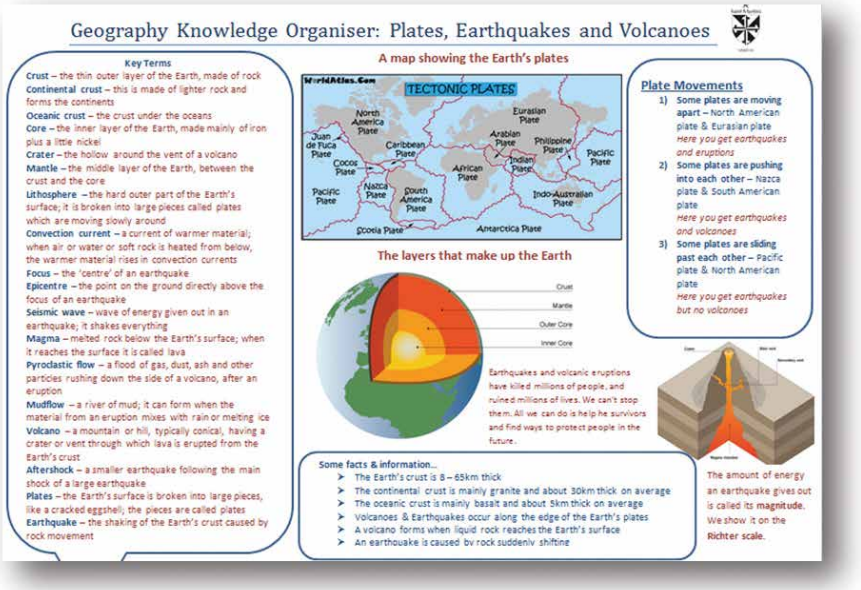
Intrinsic cognitive load: can be reduced by breaking down the subject content, sequencing the delivery so that sub-tasks are taught individually before being explained together as a whole. The aim in not to overwhelm the student too early on in the introduction of new work.

Extraneous cognitive load: can be reduced by the way in which instructions are presented. We make sense of new material by referencing schema or mental models of pre-existing knowledge. Lack of clarity in instruction puts too high a load on the working memory and so too much time is spent problem solving the instructions as opposed to new schema formation. For example, lessons that use PowerPoint with excessive text and the teacher talking at the same time can inadvertently generate excessive cognitive load and lead to working memory failures.

Germane cognitive load: refers to the construction, processing and automation of schemas. An example could be that the teacher needs to give students an explanation of the way to write an explained paragraph and all the necessary but separate elements involved. For many students too much explanation leads to a failure in remembering what to do hence exceeding their germane load. This is where the use of scaffolding comes into play and the development of models such as PEEL or ACE.

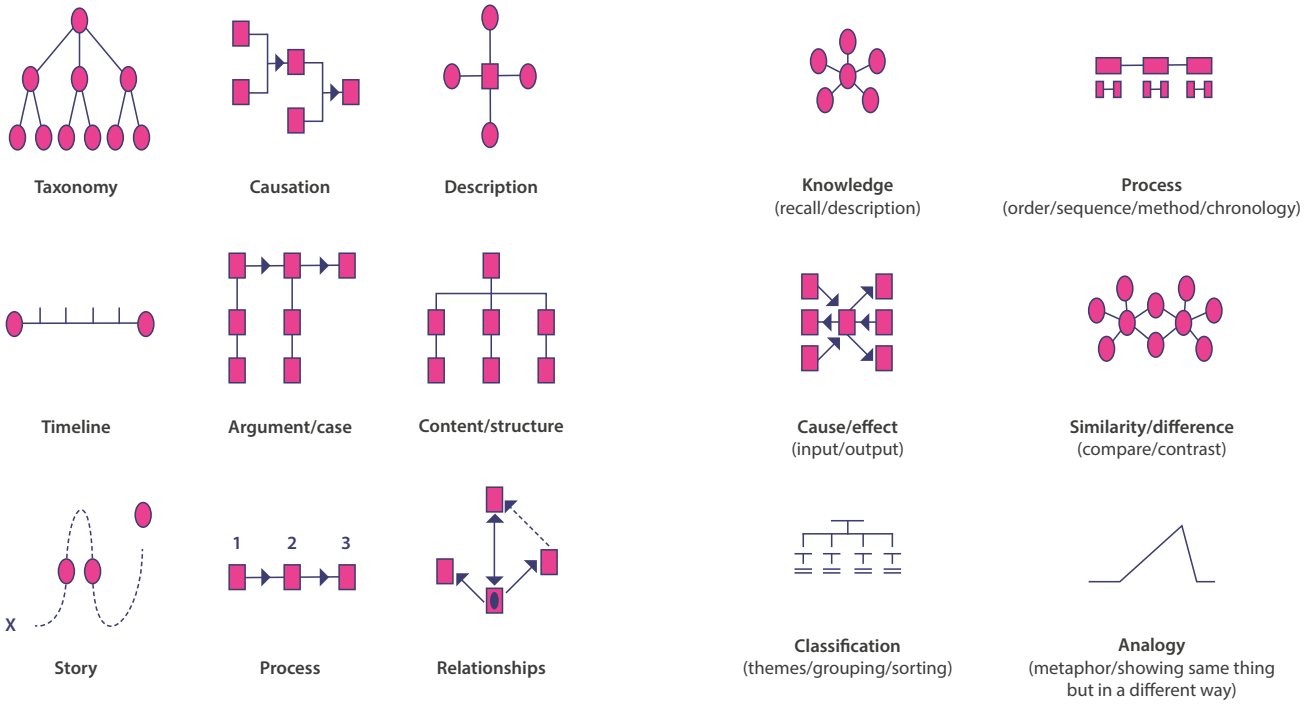
So how can we do this is in the classroom?

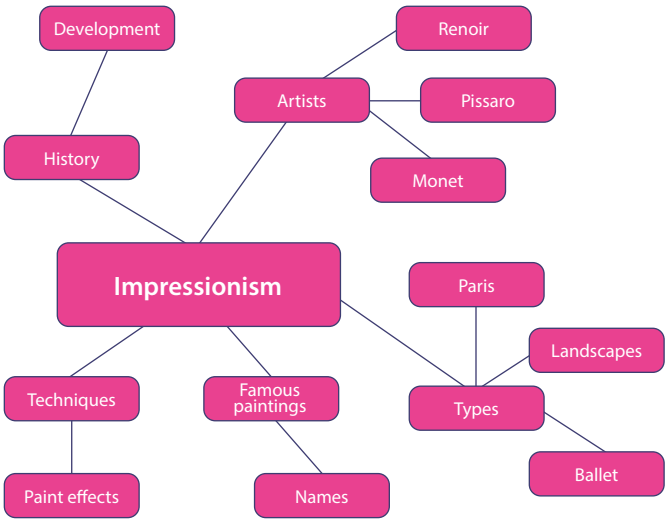
Maybe the best place to start is what <u>not</u> to do...



Clearly this teacher has spent a long time preparing this resource which is full of information which the student needs to know. However, in terms of CLT has the teacher really considered avoiding cognitive overload? Could this information be presented in a different way to extract information from the students which can be more easily transferred to the ***long term*** and ***infinite*** memory. Taking a CLT approach, maybe the teacher could have used the graphic organisers shown opposite.

One of the aspects of CLT which I now use in my teaching is graphic organisers for dual coding. Organised information is much easier to remember and when information is stored in more than one way there is a better chance of retrieval. According to this theory, presenting the information in any of the following ways will indeed increase the potential for students to avoid cognitive overload. Maybe the information in the above example could have been presented in the following ways:





In fact, any topic can be broken down in this way. Here is an example from Art and Design of a knowledge organiser, most importantly prepared by the student and guided by the teacher.

What I take from CLT is the consideration of how and why I am presenting the information the way in which I am. I can see the logic in using any of the above models to draw out the information from the students. Re-organising the presentation of the required theory will, according to CLT, allow students to access and process the information in a more efficient way and, most importantly, get this information into the long-term memory of my students, which as a teacher is where I want it to be!

Further reading

This T&L Cognitive Load Theory spotlight paper is only an introduction and I hope will act as a source of inspiration. Should you want to investigate further, I would direct you to the initial research by John Sweller. Whilst developing Cognitive Load Theory, Sweller published a paper on the subject in the journal *Cognitive Science* in 1988. This research was also updated in 2010.

Texts

Cognitive Load Theory: A handbook for teachers
Steve Garnett (31 August 2020)

Cognitive Load Theory (Explorations in the learning sciences, instructional systems and performance technologies)
John Sweller, Paul Ayres, et al. (30 March 2011)

Cognitive Load Theory
Jan L. Plass (24 June 2010)

Responsive teaching
Harry Fletcher-Wood (5 June 2018)

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