

Building mental models

In this section we will explore strategies for how you can support the recall and retrieval of knowledge and build well-developed mental models in pupils to support deeper understanding of concepts and topics.

Strategy 1: Building on prior knowledge

'The working and long-term memory' session in this module looks at the importance of linking new learning to pupils' prior knowledge as a strategy to avoid overloading the working memory. The importance of doing this is highlighted further in this section by recognising that building on prior knowledge also leads to a more developed mental model. This means that when a new piece of information is added to the model, it will be processed and understood in relation to the existing information. The more linked the knowledge is within the mental model, the more likely it is for the pupil to retain the information.

What mental models may pupils have?

It is important to note that for most topics taught in schools, pupils will come with an existing mental model. This model, however, may be small or unorganised, and will most likely contain large knowledge gaps and misconceptions. This makes your pupils novices in the concepts and knowledge to be learned. As the teacher, you will have a relatively developed mental model in the topic, making you an expert. This is an important distinction, as novices and experts think and learn about concepts in a different way.

Novices

For novices, the gaps in knowledge need to be identified and content explicitly taught so that the teacher can be sure that strong foundations are in place, and mental models can develop in an organised way. Lessons should be sequenced carefully so that the foundational knowledge around a concept is secure, before encountering more complex content. Where this does not happen, the teacher may be building on unstable foundations, leading to further misconceptions later.

Experts

As an expert in the topic, it is easy for teachers to underestimate the amount of explicit teaching and practice required for what may appear a relatively simple concept. An expert can quickly absorb and make sense of new information, hanging it on existing knowledge. However, for novice learners to process information into their long-term memory takes considerable teaching, practise and revisiting.

Strategy 2: Spaced exposition and practice

A further way to support the recall and retrieval of knowledge and build a well-developed mental model is through spaced exposition and practice. Spaced practice means that opportunities to review information previously taught are integrated into the curriculum at spaced intervals.

Why use spaced practice?

Studies have shown that pupils remember much more when they have been exposed to information on two occasions, rather than just one (Pashler, 2007). Spacing practice increases the storage and retrieval strength of the information, making it more readily recalled into the working memory for problem solving.

Here is an example of [medium-term plans for Year 9 History](#). The teacher has thought carefully about the sequence in which the knowledge will be introduced to pupils. Within the plans they have included a column to outline what the spaced practice focus will be each week (column 5 on pages 2-26). You can see that in Step 6 of Year 8 (pages 2-4, the table that outlines content covered in the last half-term of the previous year) and on Step 1 of Year 9 (pages 5-9, the table that outlines content covered in the first half term of the current year), the topic 'The Treaty of Versailles' will be revisited multiple times and will continue to be revisited throughout the year. This helps to ensure a better chance of high storage and retrieval strength and a more developed mental model around this topic.

Strategy 3: Retrieval practice

The final strategy is to use retrieval practice to support the automatic recall of key knowledge. Retrieval practice is different from simply revisiting the material. Instead, pupils are asked to recall knowledge from their memory. Some levels of forgetting are inevitable, however forgetting some of the information and then trying to recall it actually strengthens the eventual learning. Creating regular opportunities in lesson time for pupils to recall information from previous lessons will support them to build long-term memory and will allow you as the teacher to check what pupils are remembering, and if any misconceptions have developed.

How can you build this into your classroom practice?

An effective method of providing retrieval opportunities is through low-stakes quizzes. These are simple to create, quick

for the pupils to complete, and the answers can be shared immediately for instant feedback. It also allows you to draw questions from the previous lesson, or further back in the unit.

Here is an example of a simple [low-stakes retrieval quiz](#). As you can see, it focuses thinking on the key knowledge that the teacher wants pupils to recall.

Hear from a teacher

Listen again to teacher Lee Donaghy talk about how he used retrieval practice to secure knowledge into the pupils' long-term memory. If you wish, you can make notes on this using the [notes tab](#) (or your own notebook).



Direct Link: [Retrieval practice - Lee Donaghy, Teach First](#)

Transcript: [Retrieval practice - Lee Donaghy, Teach First](#)

As pupil knowledge became more secure, Lee began to increase the challenge of the retrieval practice by asking pupils to instead apply their knowledge to a task. With the knowledge held within the mental model now being so secure, he felt confident that the pupils could create new links to strengthen the model further.

As pupils become more secure in their knowledge and their mental model becomes more developed, you should be able to increase the intervals between the spaced practice and increase the level of challenge of the retrieval task.

Developing a well-curated retrieval quiz is something you will explore during your seminar 'Building well organised mental models'.



Over to you!

Re-watch the video from 2:24 to 3:23 and answer the following reflection questions:

1. In your practice how do you:
 - ensure pupils have the foundational knowledge they need?
 - extend pupils' learning beyond using a retrieval quiz?
2. Why do you think this is an important for developing complex mental models?