

ECT Mentor session

Module 2: Engaging pupils in learning

Week 2: Prior knowledge, memory and misconceptions

Session Elements



collaborative
learning



discuss with a
mentor

Learning Intentions for his session

Your ECT will learn how to:

Build on pupils' prior knowledge by:

- 2d. identifying possible **misconceptions** and planning how to prevent these forming.
- 2e. linking what pupils already know to what is being taught (e.g. explaining how new content builds on what is already known).
- 2f. sequencing lessons so that pupils secure foundational knowledge before encountering more complex content.
- 2g. encouraging pupils to share emerging understanding and points of confusion so that **misconceptions** can be addressed.

Deliver a carefully sequenced and coherent curriculum by:

- 3e. being aware of common misconceptions and discussing with experienced colleagues how to help pupils master important concepts.

Avoid overloading working memory by:

- 2a. taking into account pupils' prior knowledge when planning how much new

information to introduce.

- 2b.** breaking complex material into smaller steps (e.g. using partially completed examples to focus pupils on the specific steps).
- 2c.** reducing distractions that take attention away from what is being taught (e.g. keeping the complexity of a task to a minimum so that attention is focused on the content).

Introduction

In their self-directed training session earlier this week, your mentee began to examine the ways in which learning rests on the interplay between new information and prior knowledge, with working memory acting as a sort of 'conscious mental workspace' within which this interplay occurs, and long-term memory providing stores for prior knowledge of ideas and how to do things. They considered the relationship between long-term and working memory, using an illustrative exercise to examine how activation of prior knowledge from long-term memory can reduce the load on working memory load, which has limited capacity. They also noted that where prior knowledge is weak, it can lead to errors in their immediate activity and the learning that results from this. They applied insights from this session to examples from their own past experience with pupils and to a lesson plan for use in their teaching in the forthcoming week.

The learning outcomes from their self-directed study were to learn that:

- 2.1 **Learning** involves a lasting change in pupils' capabilities or understanding.
- 2.2 **Prior knowledge** plays an important role in how pupils learn; committing some key facts to their **long-term memory** is likely to help pupils learn more complex ideas.
- 2.3 An important factor in **learning** is memory, which can be thought of as comprising two elements: **working memory** and **long-term memory**.
- 2.4 **Working memory** is where information that is being actively processed is held, but its capacity is limited, and it can be overloaded.
- 2.5 **Long-term memory** can be considered as a store of knowledge that changes as pupils learn by integrating new ideas with existing knowledge.

- 2.6 Where **prior knowledge** is weak, pupils are more likely to develop misconceptions, particularly if new ideas are introduced too quickly.
- 3.4 Anticipating common **misconceptions** within particular subjects is also an important aspect of curricular knowledge; working closely with colleagues to develop an understanding of likely misconceptions is valuable.
- 3.5 Explicitly teaching pupils the **knowledge** and skills they need to succeed within particular subject areas is beneficial.

In this session, you will help your mentee build on this previous activity, focusing for the most part on its practical implications. It is crucial for your mentee to become alert to potential misconceptions (2d, 3e), take into account pupils' prior knowledge when planning how much new information to introduce (2a) and consider the best means of linking this new information to what they already know (2e). It is equally crucial that they appreciate how to sequence lessons and plan activities to build a firm foundation of effective understanding that will provide the basis for organised growth of increasingly complex stores of knowledge within long-term memory (2b, 2c, 2f). You will help them consider ways of identifying 'in conflict' misconceptions (2g) and discuss how to sequence lesson content to provide a more secure base for future learning. You will also assist them in developing activities and approaches to be tried in the classroom, starting with their planned activity for promoting working memory/long-term memory exchange to reduce working memory load.

Key goals include helping them to a) recognise the extent of their pupils' prior knowledge and how (and how much) new material should be introduced and b) plan for creating a foundation of facts in long-term memory to reduce load on working memory when introducing new concepts.

Research and Practice Summary

Drawing on long-term memory to support working memory in Year 9 English

Hasan is teaching Macbeth to a Year 9 English class of mixed attainment. He wants his pupils to be able to explain the likely impact upon an Elizabethan audience of witches appearing on stage in Act IV, Scene 1. They studied the Witch Craze in

history last year, and they met Macbeth's witches in Act 1 earlier this term.

How might Hasan prompt knowledge of witches from his pupils' long-term memories to support their achievement of this learning objective?

Knowledge can be defined as familiarity, awareness or understanding of facts, information or skills. Knowledge can refer to a theoretical or practical understanding of a subject. It can be implicit (as with practical skill or expertise) or explicit (as with the theoretical understanding of a subject). Knowledge acquisition involves complex cognitive processes: attention, perception, communication, and reasoning; this can happen through experience or education.

If a pupil has a poor store of prior knowledge in their long-term memory (i.e. if they are a novice), they are likely to struggle to acquire new knowledge in lessons because their grasp of foundational concepts will not be secure, and their working memory can become overloaded. (This is referred to as Cognitive Load.) One of the most important aspects of teaching is the ability to establish an accurate understanding of the pupils' **prior knowledge** within a given subject or domain. In this way, the teacher can start with where their pupils are and help them from there rather than working backwards from a long-term learning goal. It is also understood that increased prior knowledge reduces working memory load. When pupils encounter familiar problems, information from long-term memory is activated and supports working memory, where problem-solving occurs. Novice pupils therefore find complex activities like problem-solving, critical thinking and creativity particularly effortful, as they have fewer experiences (and therefore less prior knowledge) and the problems they encounter are more likely to be novel. As children develop, they accrue more knowledge across a range of contexts. This reduces the load on their working memory, allowing them to solve problems more rapidly. Conversely, where prior knowledge is weak, inaccurate or misapplied, it can have a distorting effect both on the immediate activity and on the learning that results from this. Relevant prior knowledge may be missing, incomplete, or in conflict with the requirements of current activity.



To help you address the prior knowledge needs of your pupils, you should:

- take account of it when planning how much new information to introduce (e.g. in the previous week do a quick diagnostic assessment using mini-whiteboards or do some true/false questioning)
- provide explicit modelling and guidance, breaking problems down into steps (e.g. by thinking aloud as you give a practical demonstration, highlighting the parts some pupils will find hard)
- use worked examples with clear and minimal steps
- identify likely misconceptions and plan to prevent them from occurring (e.g. ask your colleagues about this if you have the chance to co-plan with them)
- give them regular, purposeful practice so they can consolidate learning in their long-term memory

Hasan suspects that some of his pupils have poor prior knowledge. What allowance for this could Hasan make in his lesson or before?

Misconceptions typically occur when a pupil incorrectly applies prior knowledge and understanding to a new context. For example, they might mis-remember a spelling rule, they might use a definition of an important concept in error or they might mis-apply a maths rule, for example, by consistently leaving out an important step.

Some misconceptions are popular myths (e.g. thinking that the sun goes around the earth, that humans evolved from monkeys or that the Great Wall of China is visible from space). Others are personal misunderstandings that individual pupils pick up by mis-hearing, mis-reading or mis-remembering. Once 'learned', these misconceptions can become embedded in a pupil's thinking and are assumed to be true. As a teacher's subject knowledge deepens, they learn to anticipate where these misconceptions commonly arise. However, it remains important – often through quick-fire closed questioning or multiple-choice questions– to check for misconceptions in pupils' prior and emerging knowledge and then address these through teaching.



To help you anticipate and overcome misconceptions, you should:

- discuss with experienced colleagues what the common misconceptions are for an area of study and the steps they take to help pupils master the important concepts
- use quick-fire closed questioning or hinge questions to check for misconceptions in pupils' prior and emerging knowledge and then to address these through teaching
- encourage your pupils to explore their emerging understanding so you can see where they may be confused (e.g. this could be through a 'what do we know about X?' type of discussion at the start of a topic)

What did Hasan do?

At the end of the previous lesson, Hasan did some quick-fire true/false questioning to quiz his pupils on their prior knowledge in their long-term memories and to bring misconceptions to the surface. (e.g. 'Witches lived in England in the past. True or false?' 'People believed witches conspired with the devil and had the power to change events. True or false?').

In today's lesson, Hasan set up table discussions with these two questions: Why did people believe in witches in the 16th century? What did people believe about a witch's powers? He took feedback from table captains. This helped Hasan to gain a closer understanding of his pupils' knowledge. He was also able to correct misconceptions in their long-term memories at this stage.

To prompt knowledge from their short-term memories (from earlier this term), Hasan then posed a series of short-answer questions for the pupils to answer and show on their mini whiteboards. E.g. How many witches appear in Macbeth? In which Act do they first appear? Who do they tell their prophecy to? Who saw the witches? How did the characters in the play react to the witches?

Hasan has now freed up space in his pupils' working memories to work on the main

task, which is about audience reaction to the witches. He shows them a Globe Theatre video about features of Elizabethan theatre, such as male casting, lighting, sound effects and being open to the elements. He then models for them what a good outcome might look like, identifying key features. Individual pupils write a first draft in this lesson, ready for some peer-assessment and redrafting next lesson.

This lesson explicitly links what the pupils have learned longer ago and more recently to what they need to work on now. Hasan took 5 minutes from a previous lesson to check misconceptions in their long-term memories using true/false questions. In the main lesson, he used table discussion and short-answer questions with mini-whiteboards to bring to the surface the knowledge from their long-term memory, to free up space in their working memories. He then used a model to scaffold their writing and will use the next lesson to get instant feedback through peer assessment.

Mentor Meeting Activities

Throughout the session, try to refer explicitly to the Learning Intentions and encourage your mentee to record key points in their Learning Log. Tailor your use of the Theory to Practice activities below in response to the Review and Plan section of this session.

Review and Plan 5 mins

Clarify the Learning Intentions for this session with your mentee.

At the start of this module, you looked at all of the 'learn how to' statements for Standards 2 and 3 and conducted a module audit with your mentee: in some areas, they will already be confident and skilled; in others, they will want more practice and support from you and others. Look back at this audit now and use it to help decide how you and your mentee will make the most productive use of the suggested Theory to Practice activities below.

Theory to Practice 40 mins



1. Collaborative planning

Jointly work through your mentee's lesson plan from their last self-directed session incorporating working memory/long-term memory exchange. They had Hasan's Year 9 English lesson to work from as a model. Work together to explore how this might be refined in order to avoid cognitive overload to working memory and maximise learning.

To support this exploration of their lesson you might like to ask:

- Do you think your pupils, or some of them, might find this too hard?
- If so, could it be because their working memory is overloaded – you are asking them to handle too many 'bits' of knowledge at once?
- Have you done enough to help your pupils to retrieve knowledge from their long-term memories?



2. Discuss with mentor

Briefly discuss with your mentee their ideas about:

- how to identify when prior knowledge is weak and pupils have misconceptions
- what strategies might be effective for their class(es) in anticipating and dealing with these misconceptions

Focusing specifically on an instance of misconception that your mentee has encountered, jointly work through their ideas and how these might be refined in order to minimise the occurrence of this.

To support this discussion, you could refer to the Research and Practice Summary and use perhaps two of these prompts:

- consider how they might discover the likely extent of this misconception, both across their class as a whole and among different pupils (e.g. do a quick quiz

of their previous learning, get pupils to rehearse 'everything they remember', give a quick recap of what they ought to have learned and follow up with one or two multiple-choice questions, 'correct the teacher' – deliberately quote the likely misconception and challenge the class to point out the mistake)

- draw out implications of this discussion for what – and how – new material might be introduced
- building on their understanding of the role of memory in learning, map out a strategy for addressing misconceptions that could be used within their classroom, including providing appropriate external support and thinking about what form this should take
- draw up a list of specific ways in which lesson content might be sequenced to prevent misconceptions from occurring in the first place by sharing and reflecting on examples from your own or another teacher's planning and activity

Ask your mentee to identify three other specific opportunities in which they will apply the insights they have gained. How could they make this a routine part of their teaching?

Next Steps 5 mins

Agree with your mentee how they will now put their learning from this week's session(s) into practice in their teaching. Help your mentee to clarify:

1. the action(s) they will take and how these action(s) are expected to contribute to improving their workload and wellbeing
2. what success will 'look like' in relation to these action(s)
3. how they will evaluate their success in taking these action(s)

Note the date of your next mentor meeting, when you will check on your mentee's progress.