Early Career Framework

Core Induction Programme

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Week

2: Prior knowledge, memory and misconceptions

Session Elements

- practical exercise
- independent planning

Learning Intentions for this session

You will 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.

You will learn that:

2.4 Working memory is where information that is being actively processed is held, but its capacity is limited and 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.

Introduction

In the Week 1 meeting with your mentor, you worked through the Module 2 ECT audit, reflecting on your current knowledge and practice in relation to Module 2 of the ECF and agreeing on areas for particular focus in relation to Module 2. You should pay specific attention to these areas as you work through the module sessions.

In this first self-study session, you will look at the impact of pupils' prior knowledge on their learning (2.1, 2.2) and how knowledge changes through the cooperation of working and long-term memory (2.3). Information in working memory about a current activity (2.4) is linked to things pupils already know that are stored in long-term memory (2.5). You will work through an illustrative exercise to examine how prior knowledge in long-term memory is used to help reduce working memory load (2.4) and create new knowledge. This then provides the basis for further learning (3.5). You will also look at how weak, inaccurate or misapplied prior knowledge can have a negative effect on subsequent performance and learning (2.6, 3.4).

You should apply insights from these exercises to examples from your own past experience with pupils and to future lesson plans.

Research and Practice Summary

This reading will help you understand some of the theory behind this week's topic. We will start by introducing some of the key concepts (these are in bold). You will also see some suggestions of how to put these concepts into practice. **When using these concepts in your own practice you will need to take account of your pupils' characteristics, the context of your classroom and the nature of the material that you are teaching.**

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.

Hasan suspects that some of his pupils have poor or inaccurate knowledge of attitudes towards witches in the Jacobean period. What techniques could Hasan use to get a better idea of where pupils' inaccuracies lie?

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?').

Learning can be described as a lasting change in pupils' capacities or understanding. Sometimes learning is defined as a change in long-term memory; a wider definition of learning might include changes in knowledge, values and attitudes.

Memory is an important factor in learning. Memory comprises two elements: working memory and long-term memory. The role of a teacher is to organise teaching so that it best supports pupils to process information in their working memory and store it within increasingly complex mental models in their long-term memory.

Regular, purposeful practice of what has previously been taught can help consolidate material and help pupils remember what they have learned.

To help your pupils to learn more effectively, you should:

- build in opportunities for regular, purposeful practice of what has been learned (e.g. by getting into the habit of building practice time into all of your lessons. Practice can be done singly, in pairs or in larger groups)
- help your pupils strengthen their long-term memories (e.g. for factual recall, by quizzing them to recall recent learning, and repeating this with longer intervals; for practical skills like catching or drawing, you can space their practice over a period of time)
- anticipate misconceptions that are common within the areas you teach and develop ways of catching and correcting these (e.g. by using a series of focused multiple choice questions to identify common misconceptions; the nature of incorrect answers can inform your teaching, so these questions are sometimes called diagnostic questions)

An example of a common scientific misconception is that the seasons are caused by the Earth moving closer to the sun. A good diagnostic question would include this as a plausible incorrect answer alongside the correct answer. Misconceptions are inevitably subject specific. Therefore, discussing with experienced colleagues typical misconceptions, ways of identifying them and overcoming them will support your development as a teacher.

Working memory is where information that is being actively processed is held. 'Active processing' can be thought of as being synonymous with 'thinking'. The capacity of the working memory is limited, and it can be overloaded. (This is referred to as Cognitive Load.)

Information can enter the working memory either from the immediate environment or from the long-term memory. Having knowledge stored in the long-term memory therefore helps pupils overcome the limits of their working memory, allowing them to concentrate on the task in hand. Simply put: prior knowledge held in the long-term memory helps reduce working memory load. This enables pupils to think more efficiently using their working memory and to avoid cognitive overload.

To help your pupils avoid cognitive overloading their working memory, you can:

- take account of your pupils' prior knowledge 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)
- break complex material into smaller steps (e.g. use partially completed examples to focus pupils on each specific step)
- reduce distractions that take attention away from what is being taught (e.g. removing unnecessary animation or images from a PowerPoint slide or simplifying and sequencing instructions so that they are clearly and logically stated)
- remind pupils of what they have already been taught and how the new information that they are being introduced to relates to this (e.g. by explicitly comparing content in the current lesson to that in past lessons)

What did Hasan do?

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 long-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. For example: 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 memories and to free up space in their working memories. He then used a model to scaffold their writing and will use the next lesson to provide instant feedback through peer assessment.

Which of these strategies is Hasan likely to find useful in aiding his pupils' working memories?

Self-Study Activities

Review: 10 mins

Read the Research and Practice Summary on this week's topic. As you read, reflect on:

1. the practices that you are already doing well
2. the practices you are doing some of the time but could do more of/more consistently
3. the practices you don't use in your teaching yet
4. which, if any, of the practices in Hasan's lesson that you could adopt in your own

Plan and Theory to Practice: 30 mins

1. Practical exercise

Think about the following story, which is about the interplay of long-term and working memory. What might be happening mentally at each point:

1. Bob is introduced to the parts of a cell in Year 7 biology. His teacher explains what each part does, what they look like and where they are found in plants.
2. The next day, Bob applies what he learnt about cells to some questions about different types of specialised cells and finds this relatively straightforward. He understands why they are found in the leaves of plants, but not in the roots.
3. Two weeks later, Bob's teacher asks him what chloroplasts are. Initially, Bob struggles to recall what they are, but with a prompt from his teacher that they are green, Bob is able to recall what he previously learnt about chloroplasts.

This exercise is designed to provide a concrete example of how working memory and prior knowledge in long-term memory work together to create learning.

During the first lesson, Bob is introduced to new content. As he thinks hard about the content, he begins to encode it into his long-term memory. The following day, he is able to easily recall the new information, especially with the prompts from his notes. Again, as he works through the problems, he strengthens the links between his new learning and his prior knowledge about plants.

After two weeks, Bob initially struggles to recall the information, as it is no longer in his working memory. The prompt word chloroplast is not enough by itself to retrieve the information that he previously encoded in his long-term memory. When his teacher reminds him that chloroplasts are green, this is a sufficient prompt to enable Bob to recall from his long-term memory the things that he previously learnt.

In your own teaching, you may well have encountered circumstances where some pupils actually perform more poorly the second time they encounter a particular type of exercise.

- How far might this be explained by the sequence described above?
- How might you use checks on prior knowledge and practice work to reduce this?

To check on their prior knowledge, the second time they encounter a particular exercise, you could:

- do a quick quiz of their previous learning — you could reuse the same exercise or one that is similar
- in pairs, get your pupils to rehearse ‘everything they remember’ about the prior exercise
- 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 to them the likely misconception and challenge the class to point out your mistake

These activities also have the added benefit of securing knowledge in long-term memory. You will also make use of the same scenario in week 4 of this module.

You will revisit some of these points in your next mentor meeting.

2. Independent planning

Consider your lesson plans for the forthcoming week and identify one context where you can try to make deliberate use of the relationship between working memory and long-term memory, similar to the kinds illustrated by the activity above and in Hasan’s lesson about Macbeth’s witches:

- identify the lesson or part of a lesson that you will focus on
- write a simple plan for how you will make use of your learning about the relationship between working memory and long-term memory in this lesson or part of a lesson
- annotate your plan to show why you have designed it in this way, including where you anticipate pupils’ misconceptions, and discuss these with your mentor when

you show them your plan; where you can, connect your annotations to the Research and Practice Summary above

Next Steps: 5 mins

Bring your planning from this session to your next mentor meeting. Be ready to discuss this activity with your mentor, including raising any questions that have come to mind while completing this task.

Next Week — 3: Literacy and learning (https://www.early-career-framework.education.gov.uk/ucl)

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