Basingstoke Alliance SCITT
School Centred Initial Teacher Training

Assignment 2
Cognitive Science
—

A critical analysis of how retrieval practice can impact student learning in the classroom

Cognitive Load Theory

Dr Kelly Richens (2021) defines *cognitive science* as an 'understanding of how the structure and functions of the brain affect your ability to learn.' In other words, cognitive science is crucial to understanding how to embed knowledge and learning into pupils' minds. John Sweller (1994), meanwhile, explores the concept of cognitive load theory. While cognitive science discusses the architecture of the brain, Sweller's cognitive load theory focuses on the knowledge that one's working memory is finite, and that a teacher must mitigate this so as to avoid reaching their mental capacity very quickly. It's an extremely important factor to consider in any teaching practice, and one that has served as the foundation for a number of teaching strategies that I have ingrained within my own classroom practice. In fact, Dylan William (2017) argues that Sweller's theory is 'the single most important thing for teachers to know.'

Sweller (1994) further notes that when examining the working memory, there are three types of memory load: intrinsic, extraneous and germane. Intrinsic load refers to the complexity of the content, and how the working memory could be overloaded merely by trying to break down and understand the content. This becomes particularly important in a class like 7XXX (low confidence, low ability), where several additional steps would be provided in order to complete a task; whereas my 7XXX top set, could be handed a task with multiple strands of information, and safely decode it without too much cognitive strain. Admittedly, this was not an immediate triumph. It took several weeks of working with 7XXX to fully understand the necessary number of steps that might be required so as to avoid a high intrinsic load; and even then, I must ponder whether or not such a complex task could have been avoided with this group to begin with - was it necessary for my learning objective?

Extraneous load then refers to the instructions that pupils will receive, and how badly-worded or vague questions can overload their memory before they even attempt to provide an answer. Feedback of my lessons with 7XXX and 8XXX have demonstrated that I have a good understanding of questioning. I will naturally re-phrase challenging questions or suggest new perspectives so as to encourage student response and encourage a clearer understanding. This helps reduce the extraneous load significantly, as already their minds are not at full capacity trying to negotiate a badly-worded question.

Lastly, germane load is, as Richens (2021) also argues, 'where you absolutely want to focus your pupils' working memory.' It refers to the mental processes of thinking and processing information, and the mental resources that ultimately achieve, or rather activate, learning.

On the other hand, the long-term memory is infinite. Yet to ensure that we can safely transfer our knowledge from the working to long-term memory, and in turn, have a positive impact on pupil learning, we must first consider the effectiveness of teaching strategies - one of which I will discuss in much more significant detail next. In line with Teaching Standards 2.7 which states: 'regular purposeful practice of what has previously been taught can help consolidate material and help pupils remember what they have learned', the focus of this assignment will be on *retrieval practice*.

The effectiveness of retrieval practice on the learning process

Blake Harvard (2020) defines retrieval practice as 'a mental action'; rather than 'a specific type of activity that students do in class. It is all about students retrieving information from their memory.'

Similarly, Barak Rosenshine (2012) presents ten research-based principles for instruction, and his very first principle refers to this idea that many teachers and theorists refer to as `retrieval practice.' This is a concept that I have swiftly embedded into my own teaching practice and will therefore be reflecting on in detail over the course of this essay. Rosenshine suggests that effective teaching and learning should 'begin with a short review of previous learning.' As an example of low-stakes assessment, retrieval practice encourages and allows for the review of previous knowledge so as to help students recall words, concepts and procedures. But it is not just about recalling this information outright; retrieval practice should be tailored in such a way that students can recall previous learning effortlessly and automatically. Rosenshine argues that the most effective teachers in the studies of classroom instruction began their lessons with a five- to eight-minute review of previously covered material.

In English, the broadness of the language and core knowledge means that students must be able to recall information easily in order to complete even the most run-of-the-mill tasks. This is where I must seek to guide the students' knowledge from their short- to long-term memory; and this is done entirely through rehearsal, or in other words, retrieval. The *learn how to statements* from the initial teacher training (ITT) core framework claims that 'Requiring pupils to retrieve information from memory, and spacing practice so that pupils revisit ideas after a gap are also likely to strengthen recall.' (*Learn how* statement 2.8). I envisage to start each lesson with retrieval practice, echoing Rosenshine's *Principles of Instruction.*

My retrieval practice exercises are often structured the same, regardless of what year group I am teaching; I know what I seek to achieve through the retrieval activity, but I must tailor the process to the needs of each class. What does change, however, is the questions - both in terms of the topic, as all year groups are accessing different points of the curriculum; and in terms of challenge: for example, I may pose more challenging retrieval questions to stronger individuals or groups (such as my 10XXX or 7XXX classes); whereas with a group like 7XXX, I would adapt questioning to suit their intrinsic needs. This is a group that could easily lose track of the information due to an overly complex idea, or through a lack of consideration to Sweller's other idea of an extraneous load, in terms of the rewards of providing short, simple instruction.

Shimamura (2018) argues that if memory consolidation does not take place, then neither does learning. He suggests that the ideal place to begin the learning process is by 'relating the new information you are teaching to what students already know.' Through my own practice, I have found that among my most effective lessons are those that feature an element of low-stakes retrieval at the start. It has been particularly effective because the retrieval process serves to provide essential data to plot the next course of action within the learning process. If the class data shows that every student can recall the same piece of information successfully, then I do not have to revisit this as a focal point of a lesson; instead, I can continue to revisit the question, or perhaps topic, over a period of time so as to ensure that it is ingrained within the long-term memory. Whereas when class data shows that only a handful of students have correctly recalled the information, I can then revisit this knowledge or address the necessary misconceptions before moving on to the next learning point. Throughout all this, I will also be keen to stress the importance of the retrieval practice process, ensuring that all the students understand why it is that they are doing it and that they can acknowledge the impact it will subsequently have on their learning.

Much of this could not be possible without first establishing or creating a positive learning environment. Daniel Willingham stresses the importance of conditions in determining how well students apply themselves to thinking: 'People are naturally curious, but we are not naturally good thinkers; unless the cognitive conditions are right, we will avoid thinking' (Willingham 2009). Therefore, it becomes clear as practitioners that we hold a responsibility to create a positive learning environment that can allow students to apply the right cognitive framework, where disillusions posed by poor behaviour management and inconsistent routines threaten to upstage the learning process.

A particularly effective retrieval practice activity was during a Year 10 lesson on Blood Brothers

(Appendices 2 & 3), which I delivered on the 4th November. Using mini-whiteboards - which importantly, is a part of every student's equipment at Brighton Hill - I posed six questions to the class. Crucially, these questions targeted both knowledge of the previous lesson, as well as from the previous half-term (which echoes the aforementioned concepts raised by *LHT* 2.8), as this lesson was in the first week back after the half-term break. This meant that I was able to tap into their ability to recall knowledge on both Blood Brothers (the text that they had just started studying) and love and conflict poetry (from half-term 1). In creating and developing the retrieval questions, I tried to consider questions that may either raise potential misconceptions or focus on knowledge that may have been harder to learn or recall. As Richens (2021) argues, the best, most personalised approach to retrieval practice questions requires a focus on what you know your class has struggled with and needs to go over. Of course this is then only effective so long as I have also considered how to first accumulate, then assimilate, the class data. As all responses are given simultaneously via mini-whiteboards, I was able to gather answers from every individual. This idea is suitably reinforced by the idea posed by Tom Sherrington (2019) that good retrieval technique should 'involve all students checking their knowledge, not just a few and not just one at a time.' It became easier to ensure that every individual was able to provide an answer once I had first delivered my expectations: 'if you don't know the answer, have a guess. It doesn't matter if you get it wrong.' By encouraging students to provide an answer rather than simply revealing a blank whiteboard or a question mark to demonstrate their lack of understanding - you could call this 'opting out' - I am allowing the students to try to use what they know to find an answer, and potentially, even surprise themselves with providing a correct answer.

This idea of 'no opt out' stems from the notion of setting high academic expectations coined by *Teach Like a Champion's* Doug Lemov (2015). By blocking this escape route, Lemov demonstrates how a teacher can turn a standard or reluctant 'I don't know' response into a success, as it encourages students to answer a question that they may have attempted to avoid. Alternatively, they genuinely don't know the answer; but students can still hear or see themselves getting it right, which rehearses success. This high expectation is perhaps more commonly applied to verbal questioning - such as when you pick an individual to answer a specific question - though I have seen there can be just as much value in utilising this approach in retrieval practice.

Returning to my first lesson of focus (10XXX), it was also important to pose these six questions one at a time so as to reduce the cognitive load. The questions themselves were not overly complex, but even by putting all six on the board at the same time, students' minds are torn between questions they may

or may not want to answer, and the one that I, the teacher, am asking them to answer at that very moment in time. They will also be better positioned to filter the necessary information required for this particular question without having to think about another question or answer. I found that doing retrieval practice in this way helped complement rather than hinder the learning process.

Whilst I have observed that some teachers will on occasion, allow students to search for the correct answer from their notes if unable to provide one, I concur with the research that this is not particularly effective. Sherrington (2019) argues that retrieval practice must be 'generative'; in other words, students must be able to explore their memory, and memory alone, to check what they know and understand. This can only be achieved through removing class notes, cue cards, prompts, or any other scaffolds or cheat sheets. Getting students to find and locate correct information in written form is far different, and far less effective in terms of retrieval, than getting students to recall information from their memory. It should be a closed-book exercise, otherwise you would not gain an accurate understanding of the knowledge within the class. This is another reason why I prefer the use of mini whiteboards, because not only can you visibly access the answers of the whole class at the same time, but it also partially removes books from the equation; and therefore attain a more natural understanding of student knowledge.

On the contrary, one lesson with 7XXX demonstrated the potentially detrimental effect that retrieval practice could have if done wrong. The class was particularly slow to settle at the start of the lesson, and challenging behaviour issues meant that significant time was lost even before starting the retrieval task. The retrieval process then became rushed in order to get to the main objective of the lesson, which then compromised the data provided by student answers. To gain an accurate reading of student knowledge, the retrieval practice process should not be rushed or sacrificed. The data that I had collected from that session was not good enough to assess correctly whether or not the students had fully grasped the concepts that had been taught previously. This evidence underpins Willingham's theory that thinking can only occur under the right conditions; a poorly behaved class or poor routines will not garner the most effective results.

I am keen to capitalise on strong performance during retrieval exercises with extrinsic rewards. Having gathered the necessary data to plot the next course of action in the learning journey, I will also make sure to issue house cup points/stamps to individuals that can successfully answer more challenging questions or recall all of the relevant information during retrieval practice. 7XXX have taken to this pretty well because they know that their efforts will be rewarded, and it brings an added enjoyment to

what they previously considered a mundane activity. However, as *learn how statement* 7.6 suggests, pupils are not just motivated by extrinsic factors (related to reward). Intrinsic rewards, ones that are related to their identity and values, are also effective in harnessing motivation. It would be important, therefore, to consider how strategies within Shimamura's MARGE model (2018) could be applied to increasing intrinsic motivation (Smart target 3) so that I'm meeting all criteria within this precise learning point.

To conclude, retrieval practice is not only an essential tool in the classroom, but also a key focus in recent years among practitioners and cognitive theorists. It is hard to know what students are thinking or whether or not they have understood a concept. Without retrieval questions to determine this element of understanding, you run the risk of allowing students to maintain errors and misconceptions throughout the lesson, or if done really badly, over a period of time. As David Ausubel (1968) states, a students' existing knowledge is 'the most important single factor influencing learning. Ascertain this and teach them accordingly.'

Actions to complete (SMART targets)

1. Implement retrieval practice at any point during a lesson

Though I have found the start of a lesson a considerably effective opportunity to undergo retrieval practice exercises, as it helps assess prior learning BEFORE moving on to new information, it should not be considered an exclusive start-of-the-lesson task.. Kate Jones (2021) explains that retrieval practice is about time dedication; not just in terms of completion of the task, but also accounting for the necessary time for the vital feedback and reflection session that follows. I could therefore, consider the use of retrieval as a transition between tasks, or perhaps more suitably with a class like 7XXX, to help break up the middle of a double lesson where they are typically prone to cognitive overload. This could also help ease the transition at the start of the lesson from a simple 'Do Now' into the main lesson content.

2. Maintain the pace

When delivering retrieval practice at the start of the lesson, I will envisage to ensure that it does not disrupt the natural flow of the lesson. As seen and discussed with a lesson with 7XXX,

low-level behaviours produced a fairly unsatisfactory retrieval segment. Due to the routines that I have set in place during the term, this class know that retrieval is among the first things that they will be expected to do; and therefore should know the equipment that this will require. There should be no time lost, therefore, in getting out the right equipment or in waiting, for example, to hand out spare whiteboards or pens to any students that have forgotten them. As this is part of their classroom routine and hence part of my high expectations, I should be firmer with how students approach these expectations. I should not let the students - unless it is down to their knowledge - dictate the pace of the lesson, or the success of retrieval practice.

3. Build intrinsic motivation

I have found success in increasing motivation through the use of extrinsic rewards, particularly with 7XXX; however, I am keen to also incorporate, and perhaps completely replace any extrinsic, with exclusively *intrinsic* motivation within my lesson planning. Instead, this would allow students to deeper engage within their learning because of their own personal gain and their own desire to improve. This promises much greater long-term success as it relies on more natural motivations - with consideration to autonomy (we are much more likely to engage with activities we have chosen to do); mastery (we are intrinsically motivated to get better and better at things that matter to us); purpose (we are motivated when our actions are in service of something larger than ourselves)

Appendices

Appendix 1: Action plans

Appendix 2: Lesson plan for 10XXX session on 04.11.22

Appendix 3: Moderation/feedback from XXX for 10XXX lesson on 04.11.22

Appendix 4: Mentor feedback from XXX on 04.11.22.

Appendix 5: Bibliography

Appendix 1: Action plan

SPECIFIC ACTION	HOW WILL YOU KNOW IT HAS IMPROVED?	WHEN BY?
Implement retrieval practice at any point during the lesson, not just at the start	*Has the retrieval practice worked? If I am still gathering the same valuable data that I had when doing retrieval practice at the start of the lesson, then I can assume that the change has worked. However, there will be times when perhaps the retrieval is*	*This can be trialled almost immediately within my second placement, though I also expect to return to SCHOOL with evidence to suggest that retrieval practice can work at any time during the lesson.*
	not a success; but that must be down to the assessment of their knowledge or whether or not they have applied themselves in the right way, rather than any other determining factors.	
Maintain the pace and do not let students and the retrieval practice process disrupt the natural flow of the lesson or pursuit of the objective.	*The easiest way to determine whether or not this has worked will be through mentor and observer feedback. I will also know based on the timing and flow of my own lesson, and it will be important to reflect on this as frequently as possible.*	*Again, as the general pace of a lesson and transition between tasks/activities has been an area of focus in recent weeks, this can be considered an ongoing and continuous target with no specified end date.*

Use intrinsic rewards. Filter out the use of extrinsic rewards in favour of more personal, individual motivations.	*Students will become more reflective of their own learning, and this will need to be guided by the teacher. By giving students the chance to do this within the lesson, with reference back to their overall or perhaps individual goals, will help encourage a more intrinsic approach to their learning and motivation; and towards establishing a classroom culture where the students are responsible for setting and achieving their own goals, just as I have been in my own reflections.*	*June 2023 (to allow implementation with 7XXX)*

Appendix 2: Lesson plan proforma Lesson

Planning Tool

General information		Class information	
Teacher	XXX	Number of pupils	32
Subject	English - Blood Brothers	Ability	High/**Med**/Low/Mixed
Date & Time	04.11.2022	SEN pupils	XX XX
Class and Year Group	10XXX	LSA support	
Lesson Type	Half of double lesson (50 mins)	Academically more able	
Trainee development focus (including relevant teaching standards and targets, if appropriate, from central training/Subject specific/mentor)			
LEARN HOW TO STATEMENTS **7.4. Teachers can influence pupils' resilience and beliefs about their ability to succeed, by ensuring all pupils have the opportunity to experience meaningful success.** **4.9. Paired and group activities can increase pupil success, but to work together effectively pupils need guidance, support and practice.** **5.7. Pupils with special educational needs or disabilities are likely to require additional or adapted support; working closely with colleagues, families and pupils to understand barriers and identify effective strategies is essential.**			
Trainee's voice			

Please use this space to write your thoughts about this lesson. This could be a particular worry; a new technique you are trying or anything you want to share at all:

The group and I are still in our teacher-student transition phase. We are testing each others boundaries, but I am hoping to seize control early in the lesson.

*Behaviour concerns – Identified pupils (**initials only**) and how you can __teach__ the appropriate behaviours*

XX - new to the group, but has potential to cause trouble. It will be important to flex control early and ensure that correct behaviours are modelled and enforced class-wide.

Precise learning points

Precisely what knowledge or skills do you want the children to have learned by the end of the lesson (you can use Bloom's to make these hierarchical)

PLP1: Context refers to the circumstances that form the setting for an event, a statement, or idea, and in terms of which it can be fully understood.

PLP2: Blood Brothers is set sometime between the 1960s and 1980s.

PLP3: Willy Russell regularly draws on his life experiences and reflects on the society of the time (of writing) to shape the foundations of Blood Brothers.

PLP4: The characters in the play are fictional, but Russell uses them to comment on the strong class divide in Britain.

PLP5: Characters Edward and Mickey are raised by families at polar opposites of the class spectrum.:

Where does this lesson fit in the sequence of learning?

What have students learned before to build upon? How will learning this lesson prepare them for the next lesson?

Students were introduced to the play for the first time in the previous lesson. This involved listening and analysing the opening narration, as well as drawing inferences about the key themes and plot points of the play from the title, poster and various images from stage adaptations.

This lesson will focus on the context of the play, and what contextual information inspired Willy Russell's narrative.

Research Informed Pedagogy –The lesson!

INCLUDE timings for each of the following: Refer to relevant ppt slides if appropriate. <u>You can have more than one cycle of the below in your lesson, just copy and paste the prompts below:</u>

==**Retrieval Practice questions (write or refer to relevant ppt slide: last lesson; last week; last term; last year)**==

==Use of MWBs==

==There will be a mix of retrieval questions from the last lesson (LL) and last half-term (LHT); perhaps more heavily reliant on the latter due to it being only the very start of a new topic.==

1. ==What did we learn about Mrs Johnstone? How was she described? (LL)==
2. ==Name a key theme of the play (LL)==
3. ==Fill in the blanks: By showing the audience how the story ends before it even begins, this suggests the characters cannot…==
4. ==What does caesura mean? (LHT)==
5. ==What does enjambment mean? (LHT)==

How will you present new material in small steps (direct instruction)? (A)

As part of our contextual analysis, I will inform the class that the play was set sometime between the 1960s and 1980s. This will encourage the class to think about notable events and people within that time period and apply this to the play. By introducing the date first, this provides students an opportunity to consider the context of the play before revealing further points/information about the context and Willy Russell's intent.

Some new information is also posed in question form, encouraging discussion of new material as a collective group.

How will you model (I do we do you do? (B)

There will be several opportunities during this lesson to model as we shift through a variety of tasks. The 'Do Now' and retrieval tasks will have an individual focus, but the 'timeline' task will require teacher demonstration. I will model my expectations of the timeline, and provide an

example (either as the starting point for the timeline, or the end point), before encouraging contributions for the other from the class, and then allowing the class to continue to fill in the timeline on their own.

Students will later be allowed to pair up to come up with a context mind-map. I am not sure as to how much knowledge individuals will have on the late 20th Century, so this task will be a paired exercise. I will attempt to model, or perhaps silent teach, some of the contextual information so as to provide any struggling students with somewhat of a stepping stone.

How will you allow deliberate independent practice? (tasks):

Independent written response to Do Now question task.

Listen to the opening song and write down anything we learn/key pieces of information about Mrs Johnstone and her past.

OUTCOMES: How will you assess they know the precise learning points? (e.g. questioning/MWB/exit tickets/self assessment/peer assessment?) (D)

Mini whiteboards for retrieval practice.

What will you do if they do not 'get it' (responsive teaching)? (E)

I expect the bulk of misunderstanding and misconceptions to fall in the main 'context' task, purely based on a lack of knowledge on the subject area. This will be a new play to most and this will be only the second lesson so there will be a distinct lack of familiarity with the subject. Therefore, I anticipate potential stumbling blocks; to combat this I will look to model tasks effectively, and offer individual, or perhaps even group, support, or to be ready to adapt the tasks accordingly.

How will you provide challenge with support (questioning/extension task)? (F)

Questioning will be the most effective way to provide challenge with support in this lesson.

Key questions you will ask: (G)

What is 'context'?

How could context be significant in a play like Blood Brothers?

How does Russell use context to influence the narrative of the play? (learning objective)

What do we know about Britain in the late 20th Century?

Which misconceptions <mark>might</mark> you have to address? (H)

Incorrect understanding of the word 'context' - the correct definition will be firmly established before engaging in primary 'content' task.

Potential misconceptions of what events took place between 1960-1980.

Appendix 3: XXX moderation feedback

BASCITT Moderation Observation

Trainee Name:	XXX		Phase:	Ks4
ITT Mentor:	XXX		Week:	10
Establishment:	SCHOOL		Date:	4.11.22

Please record your comments about how the goal tracker is being used for formative assessment"

XXX is receiving precise feedback from staff across the dept and evaluates this really well, this supports his excellent progress.

Please comment on the SKAP tab and development of subject knowledge:
S

Please formatively assess trainee's cumulative progress:
WWW
- Great routines established: do now on board and you rotate to check
- RP has interleaved topics and all students attempting: this is on MWB and one question at a time reducing cognitive burden: excellent!!!!
- RP superb: you give option for ? and then 3 2 1 all hold up together so instant feedback, well done! Best RP I have seen at this stage of training, well done XXX
- Good praise and checking of all answers
- Good time bonding (1 min left) which you stick to
- Cold-calling for RP answers then a deepening question students green pen incorrect answers
- Nice manner, praising students
- Behaviour is excellent and class teacher (EV) says this is your fourth lesson and you have already massively improved your presence and behaviour with them
- Great responding to live coaching, XXX says often she starts writing on the MWB to give feedback but you anticipate it and have already made the change before she has chance to show you.
- Good I do for modelling on how to take notes on the second time of listening to the second
- Good scanning of the room to see if they were taking notes

- Good I do again for modelling the timeline activity. Everyone is focussed on you. Reg again is working really hard!
- We do again with modelling, then you do. Excellent.
- Students work in silence for the independent practice
- Real pace to your lesson and this means students are working harder than you.
- Bouncing questions around was good
- You made me want to read Blood Brothers!
- Absolutely saw everything you have been trained in: well done!

Thank you XXX, what I saw today was SUPERB for this stage of training! You have taken on all your training, responded really well to feedback and this is showing in your progress. Keep responding to the feedback and you are going to be a cracking teacher. XXX and XXX both kept telling me how hard you are working and how you instantly implement their feedback, I am so proud of you!

Moderator's Signature: XXX	**Moderator's name: XXX**

Appendix 4: Mentor feedback from 10XXX lesson (04.11.22)

XXX: Use of retrieval questions to promote success. Whiteboard used to help gain quick feedback - good idea! Modelling on own mini whitebaord too. Helps with success. guided students through task and gave them sections to help them understand where to use.

XXX: Use of my own whiteboard during retrieval is not something that I would normally do but I think it added value as it somewhat brings the teacher down to the student level - we are all doing the task together at the same time. I have made expectations clear with retrieval that it is okay not be sure of an answer and to have a go, or if really struggling to put a question mark on the board instead. However, I could then go a step further with those that are not so sure to find out exactly where their misunderstanding comes from.

Appendix 5: Bibliography

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