

Learning and Revision: By John Dalton

Preparing and passing tests is a core part of life for any student. A common misconception amongst many students is that somehow the skills gained while preparing for courses such as GCSE or A levels (or equivalent) are not that transferable or that useful in later life. Nothing could be further from the truth. A fundamental part of any examination is **memory** and your ability to access facts and apply concepts. These are skills that are required not just for your A levels, but for your degree and thereafter in your career and private life. Memory is critical to most things we do and revision and learning are all linked and dependent mostly on memory recall. **Revision**, or the act or process of revising, is a process that involves disciplined re-reading and assessment of notes and course material to ensure that the concepts and facts involved are understood and can be applied to new, often **unfamiliar situations**. The latter is used by examiners as a way of evaluating a student's comprehension of a topic and usually involves the concepts, especially in science and social sciences, being placed within an unfamiliar situation or context. If the student is not fazed by the unfamiliar and gets the answer right, then they have deeply understood it.

Revision involves the **encoding of short-term memory (STM) into long-term memory (LTM)** so that concepts and facts can be accessed when required. Indeed, research by London University has demonstrated a link between student memory quality and exam outcomes.

Students often make the mistake of trying to learn a topic without properly understanding it first. For example, a student who is weak in mathematics and who takes Chemistry at A level may try and just learn by rote ideas and concepts from a chemistry textbook without fully grasping the concepts involved. Such an approach is risky as, if a question is asked that requires application of the concept, then the student is not in a position to give a proper answer to the demands of the question. This is why many students who seem perfectly able in class, get mediocre or poor grade in examinations. Understanding something is not easy – it takes time, dedication and desire to master the topic.

The message at this stage is loud and clear. Before you start revising a topic, first you must have **understood its essence**, the key principles involved the context and possible applications. Although this is generally true for all subjects, it is especially critical in subjects such as Biology, Chemistry, Physics, Psychology, Geography and Economics. It is also true of Humanities: for example, to understand a key literature book, one must understand the core theme of the book. Equally, if trying to understand reasons for a revolution in history, one must first understand its origins and the context. As a subject, mathematics is probably in a league of its own. You need to be comfortable with logic and mathematical principles to handle A level Maths, but once concepts are understood, top grades in maths are also a question of practice. **Practice** is also central to all learning – because the more you practise in a subject and apply key principles, the more your brain secures the **neuronal connections between synapses** and the connections become stronger, thus improving thinking ability and recall. Therefore, **learning is achieved through periodic repetition, not cramming the night before!**

So the basic rule of all successful revision is to:

- Understand the concepts and principles involved first and their context, plus the interdependence with other topics
- Break down each topic into smaller discrete units of understanding, focusing on key concepts and words, phrases or dates

Knowledge Management

Once you have understood the topic you will have gained **knowledge** of that topic, which can then be applied. Please note that awareness of a topic does not equate to understanding and knowledge. In business, people talk about knowledge management and the importance of converting data into information and then converting the information into knowledge. Information is essentially facts about a subject, but which lacks coherence and connectedness. Knowledge suggests that some **meaning** can be gathered by connecting elements of information together. Just as business people need to convert data and information into knowledge, so do students when learning. A student with lots of information but who cannot connect this information into some meaning has limited knowledge of their subject. This is important for learning, but in the UK, education involves a mixture of **deductive and inductive instruction and reasoning**. At its simplest, deductive reasoning requires information and then draws conclusions from it. By contrast, inductive reasoning involves constructing general propositions from specific examples.

To be successful at exams, students must understand the important distinction between deductive and inductive reasoning. Although factual recall is still very much part of examinations in the UK, less emphasis is placed on it and more emphasis on inductive reasoning, whereby the student are asked to make predictions or provide answers about a problem based on existing knowledge. If a student does not understand or have sound knowledge of the topic, then when presented with inductive reasoning problems, they cannot easily answer the question because they cannot apply their knowledge to this new situation. **This is why understanding is critical for application.**

Some of my weaker students select a chapter of a book, go home and read the chapter and claim afterwards that they have understood it. When asked some basic questions that tease out important principles – they can be hazy on details. For example, a student of mine told me that he would go home and read the chapter from two separate text books on evolution for his A level biology revision. When he returned the next day he confidently asked me to test him – so I did. I simply asked him if individuals or populations evolve, to which he responded individuals. At this point I knew he had failed to grasp a key concept in evolutionary biology - only populations can evolve, not individuals. This student, who was

very bright, had committed the classic mistake of reading and making themselves aware of a topic, but failing to properly comprehend its key concepts.

The good news is that such a common mistake is easily rectified by good practice and **structured learning and revision**. Before any student attempts to improve their revision and memory skills, there are some important points that must be first addressed by you:

1. **Understand yourself**
2. **Find your material**
3. **Organise yourself and your environment**
4. **Learning: comprehension and memory**
5. **Consolidation**

Understand yourself: what type of person are you, how might this influence your ability and discipline to revise? What are your strengths and weaknesses? How do you best learn? What is your thinking style and approach? What motivates you to learn?

What are the main barriers to learning? Before you go any further in learning and revision, you must first address yourself and your fears. My experience tells me that fear, and not cognitive (thinking) ability is one of the greatest drawbacks to learning and progress. Students often become fatalistic and victims of their own **stereotype**. By this I mean that they begin to falsely believe in a fixed and somewhat oversimplified idea or notion about themselves e.g. “I am no good at mathematics”, or “I am poor at data questions or interpreting poetry”. When I ask a class who is good at x or y, you notice hands go up without the students even having time to consider the question carefully. They immediately believe that they are good or bad at a subject. This is what I describe as a **false dichotomy** in learning – that there is only two realities, when often the truth is far more complex and hazy.

Students who believe a certain stereotype about themselves may be creating massive mental blocks to learning, without any real independent evidence for it. It may be based on a few bad experiences of the past or a few ill chosen words from parents or teachers. If you know that maths is not your strong suit, then acknowledge the deficiency and work at it.

Do NOT avoid or mentally clam up when a question appears that involves some basic proficiency in mathematics. Most of the time, when shown the solution, you understand it.

Other terrible barriers to learning are habit and procrastination. Habits are routine behaviours that we often find difficult to give up, and indeed, may draw comfort from them. Students often have very negative or limiting habits that act as a barrier to new experience, realities and learning. For example, students who listen to music while trying to revise or always going off with friends for some fun after a revision session. Although both examples are fairly harmless in themselves, they both cause interference in **consolidating the encoding of material into long term memory for recall**.

Procrastination means failing to act and simply putting off a decision to do something. We all suffer to some extent from this, but in certain people this is a real psychological and behavioural barrier to action and progress.

Once you understand yourself better, in an honest, transparent way, then you are then in a better position to correct your weaknesses and champion your strengths. The most important thing in revision is **self-deception**. So many students (and their baffled parents) claim that “Claire or John spends many hours studying in their room, so I just do not understand why they are not doing as well as they should”. This is part of the self-deception game, which is visited on many of us into adult and professional life. Students often equate long hours spent in their room looking at books and reading as quality revision. Yet after four hours of such activity, they can recall or understand only a handful of concepts: why? The simple answer is that **quantity does not equate to quality**; many students who revise for long periods believe that they are indeed being productive. The truth is that the quality of the encoding from short-term to long-term memory is poor and filled with distractions and lack of quality revision time.

The remedy for the above - moderate discipline, a well structured revision timetable and the adoption of a positive mindset all helps.

Find your material: getting access to the right material to study is central to success in revision. That is why it also preferable to have more than one source of information. It never ceases to amaze me that students often quibble about buying more than one text source for a subject. Students should always have access to at least 3 or four different sources and various online approved sources, including YouTubes. Students should have access to:

- Up-to-date and correct specification
- Suggested recommended texts
- Additional texts: US texts often useful for visual learning
- A dictionary – both English and subjective-specific, e.g. Economics
- Student work books – approved by their exam board
- Webography of useful resources
- Past papers

Organise yourself and your environment: the place and the way you learn is vital to your success. Everyone learns in their own way, but it is important to **reduce unnecessary distractions** that can prevent consolidation of learning and interfere with encoding of short-term into long-term memory. Try and reproduce the conditions in which you will be tested in order to learn and revise, i.e. a silent room, maybe a clock ticking away and a small, exam-type desk. This type of learning is called **state-dependent** and is learning associated with a particular state of mind.

Good ways to organise yourself and environment:

- Have everything you need around for quick access – this makes learning efficient
- Ensure that you organise your notes in a logical order – have access to past papers and the specification
- Have access to examiners’ reports and model answers from the exam boards
- Ensure that the room where you work is at a good temperature and that you have no major noise distractions

- Revise for 20-40 minutes, stop, take a break and do something quite mindless, like kicking a ball or something very basic and not demanding
- Make summary notes using key terms and create time limits on when things should be learnt by: in effect, give yourself a time-limited challenge
- Sometimes, it can help to revise and relax oneself with some *very low* classical music in the background

Bad ways to organise yourself and environment:

- Revise with loud music in ones ears or in the background
- With a messy file and notes all over the room
- With no access to past papers, examiners' reports, the specification, textbooks ,etc
- Revise in a too cold or hot room
- Spending too much time on one subject
- Revise for hours on end without a break
- Revise a topic and then engage in an activity that dilutes or **displaces** what has been learnt

Learning: comprehension and memory

Learning cannot really be achieved unless someone has understood the concepts involved. Before any student can progress they must first grasp the basic principles of the topic – the necessary definitions, key words, phrases, people and concepts. Once this has been achieved, the process of learning, such that it can be recalled for examination purposes or direct application, has to be achieved.

Encoding, the process of creating a new memory, normally involves converting short-term memory (STM) into long-term memory (LTM). Most important memories for revision and learning are long-term. When revising, students encode by using their sensory and short-term memory, which get ultimately fixed in the long term memory. In order to convert from STM into LTM, it is important that you are paying **attention**.

Once you have a long-term memory, you will have to access it. **REMEMBER, most information and knowledge in your head is available, just not accessible.** Accessing information, facts, data, etc, is ultimately down to your ability to access the memory under the stresses of exam conditions. How many times have students left an examination only to check a book or their notes and go – “dam - I knew that, I just could not remember it.” This reinforces the importance of the quality of the encoding when revising and the need for **periodic repetition** in order to strengthen the synaptic (chemical) connections in the brain.

Your brain has an unlimited capacity to learn – it has over 100 trillion synapses - it is a sponge that can never become fully soaked with knowledge - your brain can never be full. It can get tired, but that is why it is so important when revising and learning to respect the following:

- Get a good night's sleep – a sleep-deprived brain cannot function efficiently
- Pay **attention** when learning – which means you must remove as many distractions as possible

- Achieve quality attention, hence encoding of LTM can only really be achieved in 20-30 minute intervals, followed by short breaks, then a return to study
- Do not skip breakfast – remember, compared with other organs, your brain is one of the highest consumers of glucose in your body – so feed it!

Revising with friends is only a good idea if you do not understand the topic. Once you have understood it and need to memorise it for recall, then revising with friends creates unnecessary distractions.

Ways to improve your memory

Structure within your revision notes – if your notes have a logical, digestible structure, then they are more likely to be learnt: in other words, you create mini learning platforms for yourself

Visual learning: we have very much evolved to learn visually - it is one of our memory's powerful capabilities, in particular face recognition. Using books that have coloured diagrams or having access to approved YouTubes or other types of animated online learning can be a very effective way of understanding and memorising

Memory techniques: much is written about memory techniques, but many are somewhat overrated unless practised, in which case they can be very effective. What, however, is clear is that unlike your intellect or IQ, which cannot really be much improved upon using current techniques of measuring, **your memory, by contrast, can be significantly improved with practice and techniques.** Some basic memory techniques include:

- Chunking
- Mnemonics
- The journey system
- The roman room system
- Association

Chunking

Given that our short-term memory seems to limit our ability to store more than seven or so items, chunking is a very simple, but effective method of remembering lists or more than seven items. It works by creating clusters of numbers or relating words together, making them easier to recall. For example, if you had to remember the number or code as follows – 392731938 – you could easily break it down and “chunk “ it to - 39, 2731, 1938, which allows someone to more easily recall such a number. Equally, the approach can be used for remembering list or making categories.

Mnemonics

A mnemonic is a type of memory aid that facilitates recall by making it easier for the user to access the information. Different types and mechanisms of mnemonics are recognised, such as:

Music: rhymes – e.g. child learn their “ABC..” by singing the ABC song. Or using, rhymes, “30 days hath September..”

Names: e.g. remembering the colours of the rainbow – ROY G. BIV – red, orange, yellow, green, blue, indigo, violet

The Journey System

This is a highly effective form of specific mnemonic that helps people remember and recalls items by remembering specific landmarks on a journey. So, for example, if you walk to school or college, then you probably remember all the specific landmarks on that journey. If you had to recall ten key points for a history essay on the “Principal reasons why the League of Nations Failed”, then you could more easily recall your ten key essay points or arguments by associating each one with a specific landmark on your journey to school. Central to this technique is the power of **visual memory**.

The Roman Room System

This very old technique involves the use of visual memory in a similar way for the journey system. With origins back to ancient Greece and Rome, the technique relies on recall of familiar objects within one’s house or specifically within a room. Sometimes called “The Method of Loci” – it requires the user to associate key ideas that need to be recalled with familiar objects in a room or house. Most students have a very clear and detailed memory of their house or more specifically their bedrooms, so by placing key items or ideas with a number of key objects or structures in their bedroom, this facilitates recall.

Association

Association is at the heart of all memory techniques and in many ways is the common theme of the above techniques. Memory works through connecting to some other idea or term. For example, when one considering a specific large animal, such as a buffalo or elephant, we normally associate these animals with some specific trait or behaviour. By creating associations, our memories are enhanced. A child recalls an elephant because of its size and trunk, a lion by its roar or mane. Sometimes, associates work best when they are odd or funny. For example, if you had to remember your hotel name – the Radisson, for example, you might associate it with a radish! Association techniques can be usefully applied at both GCSE and A levels and students can make them as funny and bizarre as they like, so long as they work!

What is important to take with you about memory techniques is that you have to find your own system.

Consolidation

Consolidation in learning refers to the stabilization of memory trace after initial acquisition of the memory. Memory can decay over time unless consolidated through practice and repetition, which strengthen syntactic connections. Be warned, I am not suggesting that learning something over and over again equates to understanding – it does not. One must first comprehend, but then reasonable familiarity helps strengthen the memory and improves recall. Looking at something once is usually not

enough - it usually requires at least 5 attempts, especially if it is a difficult concept. Multiple attempts are just self-defeating. So it is very important to keep practicing topics and re-visit them on a regular basis to reinforce the connections in the brain. It is very important to try and secure a whole understanding of **gestalt** of what you are learning. A gestalt is a way of looking for an essence or shape of an entity's complete form. It is very important for students to try and get a "gestalt" of a specific problem when trying to learn. It results from the interplay of language, information, logic, and the ability to connect things together to form a complete concept. For example, something as complex as evolution in biology requires a series of different concepts to fit together in order for the student to finally get the moment when it makes more sense.

So in conclusion, effective learning is not that difficult, but rarely comes easily. You must recognise your bad habits and barriers to learning - remove or reduce them - and accept that you need some degree of discipline. You also need to create the right environment for learning and have access to right resources. You cannot become a "victim" of stereotypical thinking about your abilities as this only reinforces negative thinking and framing. One must, however, be realistic – you may not be a maths wizard, but that does not mean that you are simply "no good at maths" – that's just plain defeatism. It is also dangerous thinking. All of us fail every now and then – that's perfectly normal. It what you do with the failure and how you improve that counts. So never give up, never give in, be realistic, and enjoy the most wonderful thing in life – continuous learning and discovery.