

1. The Science of Rapid Learning

Chapter 1: The Science of Rapid Learning

Introduction

You may have a fear that you aren't cut out for learning science or math. Thinking, "I'm just not a math person", or "I don't have a logical mind – I'm a creative thinker" or even "I'm just not smart enough." Maybe you haven't been presented these subjects in a way that suits your mind. You *can* learn these subjects; you just need to work with your mind, not against it. The following sections will teach you how to do that.

Optimize Your Learning Mind

The Mind is a Meaning Making Machine

What does it mean to say, "The mind is a meaning making machine."? The primary function of your mind is to take incoming information and attach meaning to it. Sometimes what is presented has no inherent meaning. For instance no one has ever really *seen* an electron orbital. Yet this is a fundamental concept in chemistry and physics. So how is your mind to make meaning out of this concept and others that do not have an inherent or obvious meaning in your life?

To find meaning and learn new information it must first be relevant. For instance do you:

- Like baseball?
- Play video games?
- Like music?
- Follow the political process?

If you answered yes to any of these questions, you found something in these topics that made this information relevant. To master any subject – especially those that are "hard" – **use the mind's quest for relevance to develop meaning.** This is done by making these subjects relevant to you. Learning trigonometry is easy when it is relevant: you balance best when you are at 90° with respect to the floor, at what angle do you topple over?

Take Advantage of Patterns

In addition to finding relevance, finding patterns in what you are learning also helps creates meaning. In fact, "intelligence" could simply be described as being able to see and construct patterns from the world around you. Finding patterns is finding a

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relationship between facts or concepts. For example, when learning the amino acids you can group the 20 molecules by non-polar side chains (i.e. glycine – CH₃), uncharged side chains (i.e. serine –CH₂-OH) and charged (i.e. lysine – CH₂-CH₂-CH₂-CH₂-NH₃⁺) polar side chains. **Use the brains natural tendency to find patterns in any subject you are learning.**

Emotion is Key in the Learning Process

Emotion plays a role in how we learn - if you are anxious about taking a test and haven't eaten or slept, learning the material is made more difficult. However, we also know that being over-relaxed (often as a result of understimulation) can lead to boredom and a lack of motivation. **The brain needs a non-threatening environment with enough challenge to evoke an emotional investment in the subject.**

Use these practical tips to engage your emotions and to evoke an emotional investment:

- Write out your goals (including why you want to achieve them), stick them by your computer and read them every morning.
- Journal about what is going on for you emotionally while you are studying.
- Make time for those things that you know are relaxing, walking the dog, listening to music, exercise.

Learning Environment is Vital

Craft your environment so that learning is favored – eat, sleep, limit the distractions – and don't let a little frustration while you are learning get you down; it enhances the whole process.

Here are a few tips to enhance your learning environment:

- Create a study zone away from distractions (library study area, quiet room somewhere).
- Don't multi-task: turn off your phone and mp3 player or leave them at home or in your car.
- Lighting, seating and temperature should be comfortable but not overly so. You don't want to become too relaxed.

Multi-Modal Learning is Highly Effective

Learning is a complex process. **Interacting with your environment enhances all aspects of learning.** It is a mistake to think that full concentration on the subject

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of interest is what is going to ensure rapid and lasting learning. Countries that require music and art classes have higher overall standardized test scores than countries that do not.

Tips to practice incorporating your environment into your study:

- If you have a hobby, nurture it. Treat it as part of your learning practice not as a reward once you attain a goal.
- Surround yourself with those things that please and stimulate you, art, music, or your favorite movies.

Treat Mind And Body As If They Are Connected



Just because the mind and the body seem to be separate from each other, that should not lead you to believe that thinking and movement are independent of each other. **Research shows that areas of the brain that are important for movement are also vital for learning.** How do you take advantage of that fact? Exercise increases the chemicals in the brain that allow us to respond rapidly to learning challenges. Rapid learning is enhanced by something as simple as exercising 20 min a day.

Tips to enhance your actual study time:

- Make time to incorporate exercise or movement into your daily routine.
- If you are stuck when trying to learn something new, take 20 min. out to dance or walk or run.

Every Brain Registers Information Uniquely

Every mind is unique. Accelerate your learning by taking advantage of the unique way in which your mind takes in information. You may have noticed that you learn quite easily if the information is presented to you in a certain format (e.g. outlined before the lecture) and that other formats frustrate and confuse you. You may be the type of person who can learn easily while the teacher is talking and writing on the board, or you might be someone who can't comprehend anything unless you are doodling while someone else is talking. **Instead of resisting how you take in information, take advantage of how you learn.**

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Example: You are attending a Chemistry laboratory, before the experiment begins the teacher wants to make a couple of points about the experiment.



- 1). She has written a few notes about the compound you will isolate on the board.
- 2). She has a model of the compound and is talking about the chemical structure.
- 3). The instructor has beakers and flasks with the compound at different stages of isolation sitting on the laboratory bench. She demonstrates how to use the ring stand to safely attach the flasks.

So what information did everyone in the class absorb? Depending on your learning strengths, different information has been imparted. For the student preferring *Kinesthetic* learning, the main message imparted was how to physically do the experiment: swish the flasks, attach them to the ring stand and so forth. If you prefer to learn in a *Read/Write format*, the notes on the board are copied carefully and may be annotated by pictures of the set up. You may, however, have missed the verbal instructions about how to attach the flasks or use the instruments. If your strength is as an *Aural* learner, her verbal instructions are crystal clear and other aspects such as handouts were missed. The student with a more even balance of modality strengths or preferences (*Multimodal*) will take a bit of everything that is presented. Depending on their unique combination of learning strengths, a different take home message has been acquired. Each of these four students, if asked to summarize the pre-lab discussion, would undoubtedly come up with a variation on the lecture.

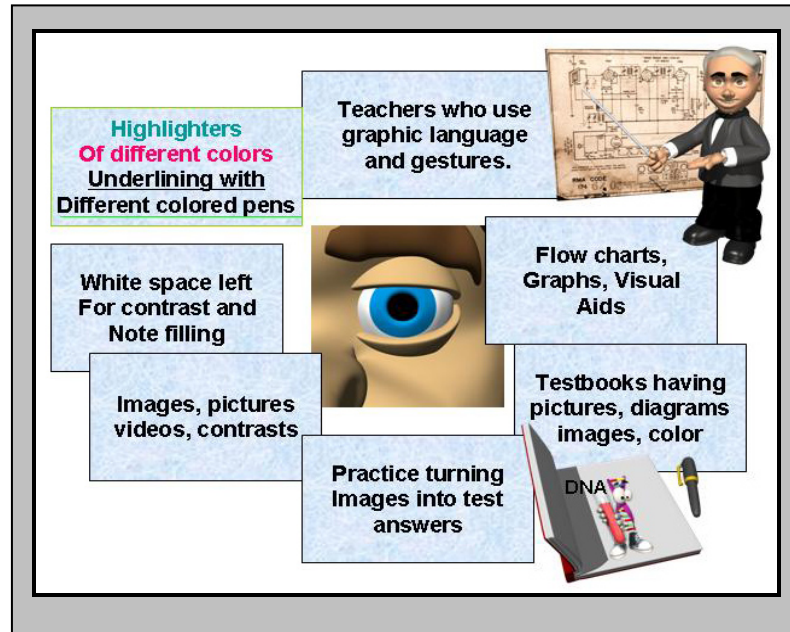
When learning strengths and preferences are understood, optimized and utilized, it is easier to compensate for weaker modalities. Once you have determined your learning strengths, you will experience a new level of freedom and power over your ability to learn any subject.

The VARK Learning Modalities

VARK is an acronym for *Visual, Aural, Read/Write and Kinesthetic* and used to describe four common learning modalities. VARK is also a method that when applied will help optimize the preferred learning strength of an individual. By knowing, for example, that a person prefers to learn by using pictures, study guides and notes can be created that are heavy in images. This will make learning easier and memory

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or retention of the information better. By “learning how to learn” anyone can be a good student and you will have the satisfaction of knowing more about your self.

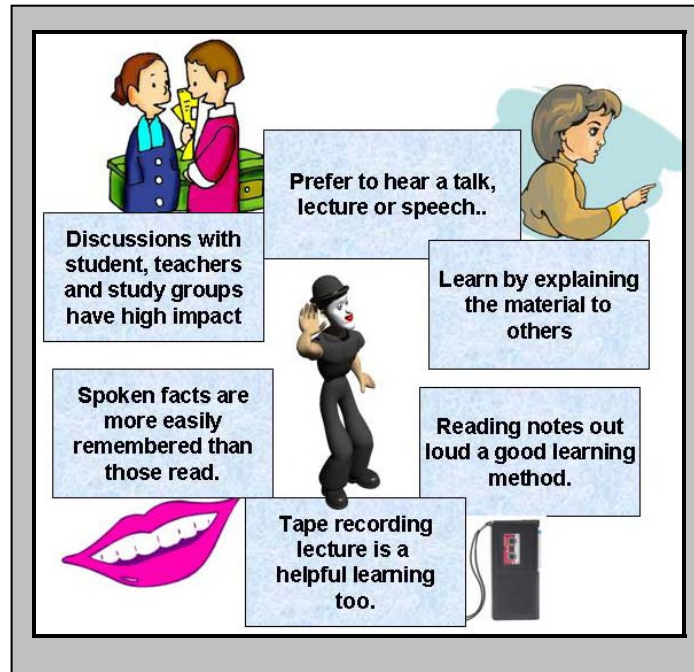


Visual Learning

1. Visual learning is characterized by a holistic approach to learning subject as opposed to reducing the subject to its smallest parts and reconstructing. The appearance of the subject its color, texture and design are interesting and drawing comes naturally.
2. Student prefers to learn material as a series of images.
3. Image types include: diagrams, symbols, flow charts and graphs.
4. Text is made more like an image by underlining with different color pens or highlighting. As an example a chemical symbol may be drawn to look like the atom or molecule.
5. Symbols and spaces are used in place of words.
6. Optimal lectures would include gestures and language that is image driven.
7. Textbooks and handouts having concepts displayed as diagrams, pictures and graphs are preferred. If a course text book does not have adequate images look at other books and on the internet for images of the topic.

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8. To prepare for exams, which are usually written, translate materials such as lecture notes, text books and hand outs into diagrams, images, flow charts etc.
9. Practice turning visual clues back into written words for exams.

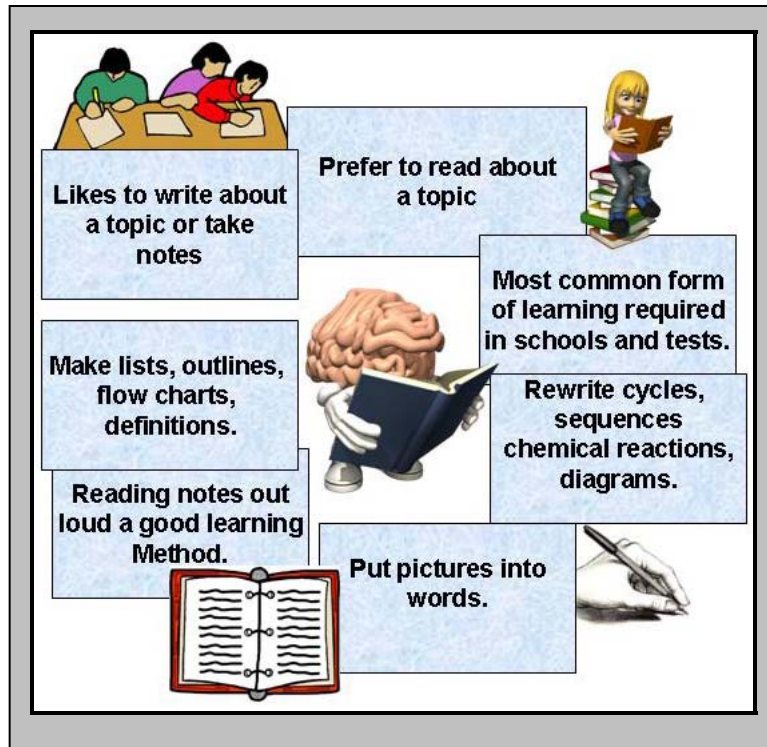


Aural Learning

1. Learners with strong aural abilities prefer hearing something to reading it.
2. Effective learning is enhanced by explaining what they have heard and being asked questions verbally.
3. Lectures are enjoyable experiences.
4. Discussions with other students, teachers and presenters have high impact and learning value.
5. Can remember what is spoken more easily then what is read.
6. Often taking notes of a spoken lecture is secondary to listening so notes may have to be augmented by listening to tape recordings of the lecture or speaking to others.
7. Information mastery is acquired by teaching or "speaking" about it to others.

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8. Reading your notes out loud, even just to yourself is an excellent method to again hear the material.
9. To answer exam questions it is helpful to imagine that you are talking to the teacher or examiner and verbally giving the answer. Listen to the answer in your mind and write it down. This can be practiced by going over previous exams and practicing listening to your inner voice and writing it down.

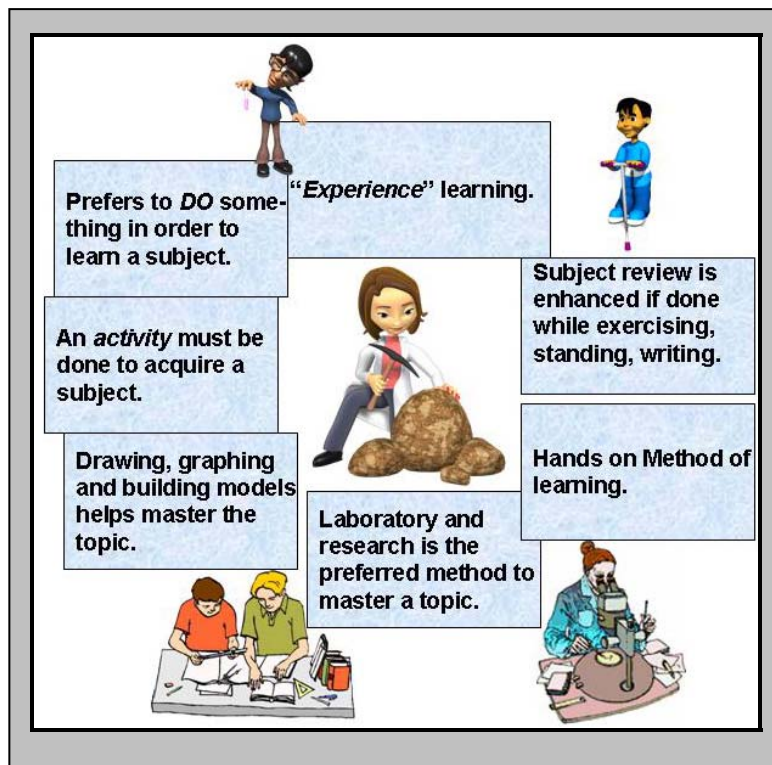


Read / Write Learning

1. Read / Write learning is characterized by preferring to read about a topic and then to write or take notes. Lectures and pictures are fine but you prefer to read about what you are learning.
2. Schools and colleges mostly require students to demonstrate learning in written form usual emphasizing reading.
3. If you prefer to learn by reading you benefit by: making lists, outlines, and writing definitions.
4. Learning material include: textbooks, dictionaries, and handouts.

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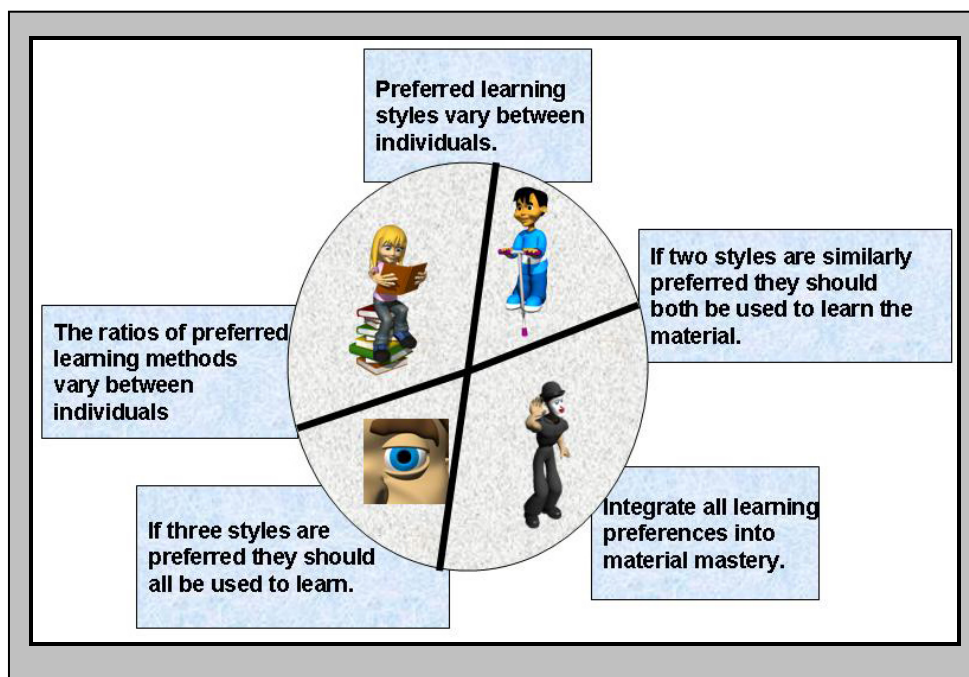
5. Mastery of the material is by writing what has been read. This would include writing definitions, cycles and sequences, changing reactions, augmenting diagrams and pictures with words.
6. To prepare for tests it is useful to rearrange lists and notes into questions, multiple choice and essay and to write the answer. Lists and descriptions written should be rewritten. Words and concepts should be arranged into primary points and hierarchies.



Kinesthetic Learning

1. Kinesthetic learners like to experience learning and exams.
2. The preferred method of learning is by “doing” something. A subject is only meaningful if it feels practical, and relevant.
3. To acquire information and to master it an activity must be done.
4. “Hands On Method” of learning is beneficial, e.g. performing experiments, building models and test taking.
5. It is helpful to review a subject while exercising, standing, writing, or drawing and role playing.

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Multimodal Learning

Most individuals are multimodal learners. That is they do not show an exclusive preference to one learning modality but blend their preferred methods. For example a person who prefers to listen (aural learner) but is also visual may record a lecture and draw pictures or schematics of the topic. The blend may include 2, 3 or all four methods of learning. To maximize your time learning it is useful to use as many as the modalities as possible in the process. For example by listening to a taped lecture and rewriting notes to images, three styles, aural, visual, read/write are incorporated into the activity. This is useful for the multimodal learner.

Critical Thinking: How Critical is it Anyway?

Critical thinking is a process where a subject is conceptualized. This typically requires the breakdown of the information into its components. The components are then reassembled into a format that is relevant to the student in the preferred modality.

There are many advantages to critical thinking. First it removes the need to memorize the material because the topic is understood. Additionally the material can now be applied to different situations. An example of this is an organic synthesis. A student can memorize each step of a synthesis $A \rightarrow B \rightarrow C \rightarrow D$. Alternatively or by critically analyzing the process identify reactive bonds and

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reaction products and apply this knowledge to the formation of compounds in each step.

In science and math critically analysis allows real mastery, allowing the student to make inferences, conclusions and predictions.

Strategies in Critical Thinking:

- Group all the relevant facts together.
- Break the facts into component parts and draw out implications of each.
- Verify that each fact is internally consistent and doesn't contradict another fact.

Step By Step Process

- What is the objective of the lesson, method, function?
- Is the conclusion supported by the facts?
- Does this make sense?
- What are the main concepts: theories, laws, principles?
- What facts are provided?
- What are the inferences, interpretations, conclusions or solutions?
- Are there assumptions about the facts I need to know?
- How would the conclusion change if I am wrong?

Cognitive or concept maps are one method of breaking down and grouping information. There are many formats and rarely one "right" way to create a concept map. A concept, instead, displays a person's unique understanding and interrelations of concepts. In this method the facts are diagramed or charted. Ideas, words, process, etc. are linked or grouped to represent the information. Variations on the mapping of information can be done to fit visual, read/write, aural and kinesthetic learner.

Example of a Cognitive Map: Spectroscopy is a technique used in physics, chemistry and biology. Mathematics is used to analyze information. Imagine that you have been presented with a series of lectures on spectroscopy. Using critical thinking how you would breakdown a subject that encompasses so many fields of science and math?

Diagram or write out the major components of spectroscopy.

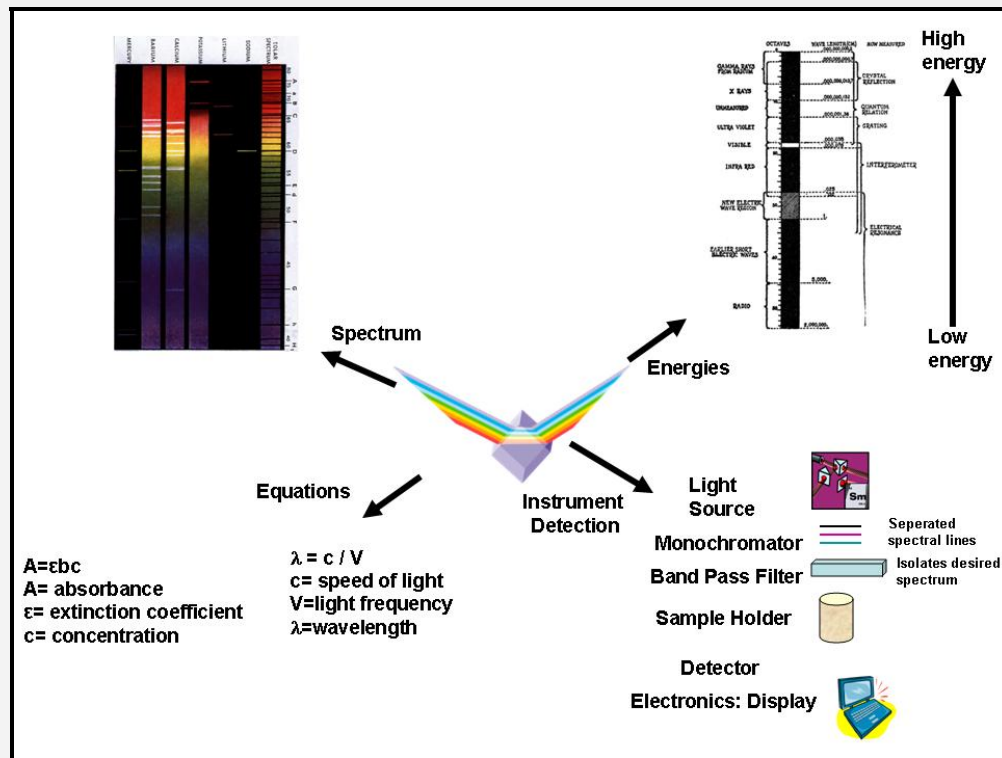
- Instrumentation: used to acquire data in the laboratory.

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- Analysis: equations described in lecture, reading and lab. assignments.
- Description (image) of what a spectrum actually consists of.
- Major aspects of spectrums e.g. energy, frequency, radiation etc.

Construct a learning tool.

This can be a list of equations or theories, a concept map or diagram that reflects what you are trying to systematically learn (critical thinking).



Goal Definition & Critical Thinking: refine the diagram or flow chart by asking your self what the goal of that series of lectures on spectroscopy is. Enhance or edit your diagram to incorporate the goal(s), objectives, facts and theories that were presented.

Using your critical thinking and learning aid(s) work some problems. See if these aids help in problem solving, does it work?

The actual format will depend on you. Perhaps instead of pictures in the above example, a Read/Write learner would have texts and lists of items in each segment. The point is to apply the step of critical thinking to breakdown the topic into logical groupings.