Learning How to Learn

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Overview

"I am always ready to learn although I do not always like being taught." – Winston Churchill

We'll be talking about different ways to become a better learner. These techniques can be applied to any subject and give you better understanding into how humans learn.

This presentation was inspired by my attempts to teach my son various things over the years. He was impulsive and could not sit down for very long to focus; he also showed little interest in school. This made me think, "How can we become better learners?" My journey lead me to a lot of great information on the internet (see links below) and also to the incredible popular and free online course I took called, "Learning How to Learn."

The material below features highlights of what I've learned about learning. They have made all the difference in the world to me and my son and I know it will for you, too!

"Focused" and "Diffused" Modes

When learning, there are times in which you sit down and study your material with little distractions (f*ocused)* and times in which you allow your mind to wander or not do your work at all (diffused). This unfocused, *or diffused*, mode is just as valuable as the focused mode in allowing your brain to LEARN something. So—**take breaks, meditate, think about other things, and give yourself plenty of time in both modes**.

One way of making sure you're taking regular breaks is to follow the Pomodoro Technique. It uses a timer to break work into intervals, traditionally 25 minutes in length, separated by short breaks. The work and break time lengths can vary based on what works best for you. The important part is that you have a regular break. There are several applications out there that help you setup a Pomodoro timer.

Diffused thinking helps with creativity and problem solving because it allows you to access the pathways you've created through focused thinking. Diffused-mode thinking is also **essential for learning math and science**.

Chunking

This is the idea of breaking down and/or grouping related information that you want to learn into concepts. The goal is to learn each concept in a way that they each become like a well-known puzzle piece. In order to *master* a concept, you not only need to know it but also to know how it fits into the bigger picture. **Chunks are also easier for the mind to store and retrieve from long term memory.**

There are several steps to the chunking process:

- Break larger amounts of information into smaller units
- Identify similarities or patterns
- Organize the information
- Group information into manageable units

Examples

Chunking is used extensively in almost every field related to computers. However, we use different terminology. In software development we chunk code in functions/methods. functions/methods into files/classes/packages. files/classes/packages into modules, modules into libraries/repositories. libraries/repositories into applications/services/micro services… In Operating Systems (hierarchical file system, user and kernel space), networking (protocol, address space layout) and many other fields. This is done for purposes of reuse, efficiency and performance, but more importantly it improves maintainability, and understanding by human beings who ultimately need to create and maintain these things.

Mnemonics

"Memory tempers prosperity, mitigates adversity, controls youth, and delights old age." - Lactantius

A **mnemonic device**, or memory **device**, is any learning technique that aids information retention or retrieval (remembering) in the human memory for better understanding. creating simple words and/or phrases to memorize complex topics and ideas is a great way to remember things. See Mnemonic Links for more info. Remember the stranger and goofier the mnemonic the easier it is to remember!

Examples

- Order of operations in math:
  to remember "Parentheses, Exponents, Multiplication, Division, Addition, Subtraction" use "Please Excuse My Dear Aunt Sally"
- to remember your Chunked Grocery List above
  "Frozen Foods , Dairy, Bakery, Fruits" use
  "Famous, Films ,Drive, Boring ,Fruits"

Beware of Illusions of Competence

"The greatest enemy of knowledge is not ignorance, it is the illusion of knowledge." - ***Stephen Hawking****.*

"The point of modern propaganda isn't only to misinform or push an agenda. It is to exhaust your critical thinking, to annihilate truth."
— Garry Kasparov

Testing

In order to avoid or break through illusions of competence, **you should test yourself as you're encountering new material**. Recall is a simple example of this testing. Testing yourself often and in small chunks is extremely helpful.

It's not important that you pass these tests without making any mistakes. Mistakes (and correcting those mistakes) are an important step towards solidifying your learning.

Examples

- Quizzes, Tests, Final Exams, Book Reports, Standardized Testing exist to improve your learning.
- Testing is critical in every part of the Software Development Life Cycle. All good developers, unit test, integration test then write code to test their code! After that we deploy it, Quality Assurance does more thorough testing! after it passes QA we deploy to prod and our customers test it. When there is an issue in production it is assigned to a developer and the whole life cycle starts again. Catching issues earlier in the life cycle saves a lot of time and money

Interleaving

Once you have a basic understanding of what you are trying to learn, interleaving can be used to help you master the concepts. By practicing jumping back and forth between problems that require different techniques, you can solidify your understanding of the concepts by learning how to choose to apply them in various situations. **Know *when* to apply a particular concept is as important as knowing *how.***

Example

After you study multiple chapters in a book and do the exercises after each chapter, then pick random exercises from different chapters and complete them to make sure you know them.

Iterative Process Over Product

When facing procrastination, think of iterative process over product. I often procrastinate when I'm overwhelmed by the thought, "Ok, I have to get X done". Instead, **it can be beneficial to think, "Ok, I will spend an hour on X"**—which isn't overwhelming, doesn't require a long breakdown of tasks, and gets me started (90% of the battle).
5 1 hour sessions over the course of 5 days is better that cramming for 5 hours the night before the test.

Examples

- When you have a test on 3 chapters. Instead of studying all 3 chapters the night before a test. Study a chapter every night, and on the night before the test your self on all chapters interleaving material from each chapter.
- Every Software Development technique I've learned values Iterative over Product. This includes but not limited to the following: coding, testing, deploying, project tracking (agile and iterative methods), planning …

More Examples

- Looking at a solution and thinking that you know how to arrive at that solution. Use all the techniques instead of jumping to the solution.
- Highlighting or underlining are also techniques that often lead to this illusion of learning. People tend to stop here. use all techniques to make sure you understand the highlighted material and be conservative with what you highlight to improve your chances of remembering it.
- Over Learning: The main takeaway on this point is not to spend too much time in one sitting going over the same material over and over again. The law of diminishing returns certainly applies. Use recall and testing to know when you should move on.

Feynman Technique

> *The person who says he knows what he thinks but cannot express it usually does not know what he thinks."*
>
> *— Mortimer Adler*

Named after the Nobel Prize-winning physicist Richard Feynman – who, in addition to being a brilliant scientist, was also called "The Great Explainer" for his ability to relay complex ideas to others in simple, intuitive ways – the Feynman Technique is a method for learning or reviewing a concept quickly by explaining it in **plain, simple language**.

Two Types of Knowledge

There are two types of knowledge and most of us focus on the wrong one. The first type of knowledge focuses on knowing the name of something. The second focuses on knowing something. These are not the same thing. The famous Nobel winning physicist **Richard Feynman** understood the difference between knowing something and knowing the name of something and it's one of the most important reasons for his success. In fact, he created **a formula for learning** that ensured he understood something better than everyone else.
It's called the Feynman Technique and it will help you learn anything faster and with greater understanding. Best of all, it's incredibly easy to implement.

How to Use the Feynman Technique

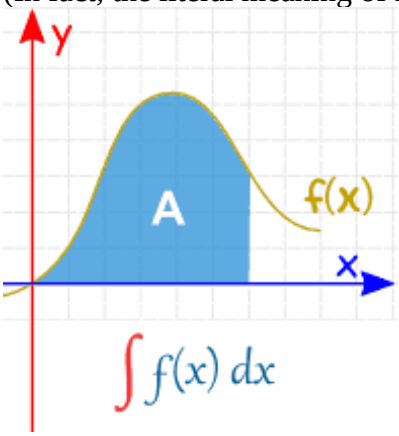
Since the root of this technique involves **explaining the concept,** you could execute it in a number of ways – including literally grabbing a friend and explaining to them what you're learning. However, you don't always have willing friends at hand, so here's the simpler method that just involves a sheet of paper.

- **Step 1:** Grab a sheet of paper and **write the name of the concept** at the top. You can use pretty much any concept or idea – even though the technique is named after Feynman, it's not limited solely to math and science.
- **Step 2:** Explain the concept in your own words **as if you were teaching it to someone else**. Focus on using plain, simple language. Don't limit your explanation to a simple definition or a broad overview; challenge yourself to work through an example or two as well to ensure you can put the concept into action.
- **Step 3:** Review your explanation and identify the areas where you **didn't know something** or where you **feel your explanation is shaky**. Once you've pinpointed them, go back to the source material, your notes, or any examples you can find in order to shore up your understanding.
- **Step 4:** If there are any areas in your explanation where you've used lots of technical terms or complex language, challenge yourself to **re-write these sections in simpler terms**. Make sure your explanation could be understood by someone without the knowledge base you believe you already have.

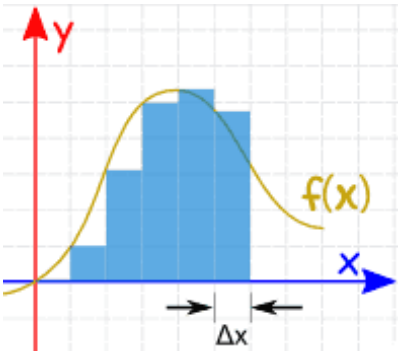
Example: Feynman Technique in integral calculus, math

Calculus, especially integration, is hard. Many just go through the motions of applying standard methods to solve integration problems without an intuitive understanding of why they're using that snake-like symbol.You can apply Feynman Technique to calculus too for explaining things simply. Here is an intuitive, simple explanation for integration:
Integral of a function f(x) is nothing but the area (the shaded portion, A) under the curve.

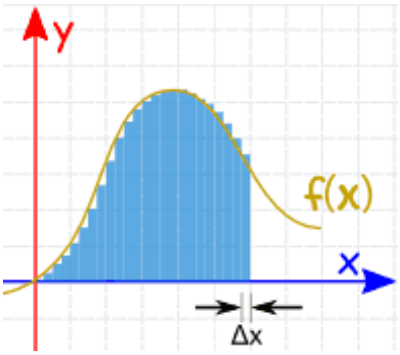
(In fact, the literal meaning of integration is combining constituents into a whole.)



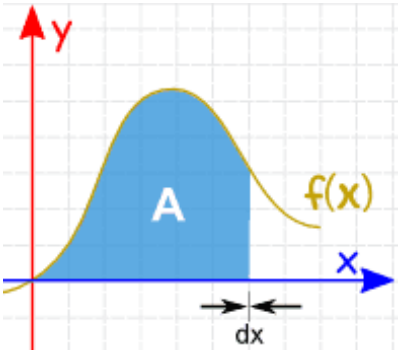
If you know nothing about integrals, how would you calculate this area?
The simplest way is to divide the area into thin rectangular slices and add areas of all the slices. (We divide the area into rectangular slices because it's easy to calculate the area of a rectangle.)



Now, this is approximate area, because the rectangles don't exactly follow the smooth curve. At points, they extend beyond the curve, and at points, they fall short of the curve.
If we want to get the area as close to the actual, then we can increase the number of slices by making them thinner.



As the width of slices approaches zero (dx), we get the true area.



And integration is the method to sum all these slices when their width approaches zero.
More intuitive! That's the power of simple explanation.

More Tips

- To avoid procrastination use iterative process over product or pomodoro technique
- Take notes with pen and paper is better than using a laptop
  - Less distractions with pen and paper than using laptop (i.e. look at this cute cat video !)
  - Rewrite/ rephrase ideas in your own words. With laptops its too easy to cut and paste
  - Rewrite/rephrase ideas by other modes of communication helps you remember and understand them better (speak, present or sing them)
  - You can still use your laptop but try using a pen stylus instead
- Study-Sleep-Study is better than Study-Study-Sleep. Because of the iterative process over product and better mixing of Focus and Diffuse Modes.
- More exercise = less stress + improve brain function + improved/faster learning https://www.additudemag.com/exercise-learning-adhd-brain/
- Stay hydrated often. Water improves processing of information and learning.
- Reward yourself after reaching a goal. We all do better when we have an incentive to do something
- We take in unconscious cues from our environment while learning/remembering. Be aware of this and use it to your advantage
  - Example: I had a thought/task for myself but I forgot what it was! A good way to recall it is to go back to the room you formed the thought and you might remember it (i.e. we are always collecting/processing/associating information around us in a diffuse ways we don't clearly understand)

Links

https://www.coursera.org/learn/learning-how-to-learn

https://medium.com/learn-love-code/learnings-from-learning-how-to-learn-19d149920dc4

https://qz.com/1377571/heres-how-to-learn-anything-according-to-a-leading-expert/

https://collegeinfogeek.com/feynman-technique/

https://fs.blog/2012/04/feynman-technique/

https://www.youtube.com/watch?v=B9SptdjpJBQ

https://www.fastcompany.com/3063173/six-brain-hacks-to-learn-anything-faster

https://www.7pace.com/blog/focused-vs-diffuse-thinking

Mnemonic Links

https://spacefem.com/mnemonics/?w=putty

https://www.mnemonicgenerator.com/

how to remember you phone number of string of numbers

https://phonespell.org/combo.cgi?n=2152668225

Quotes about Learning

“Never let formal education get in the way of your learning.” –Mark Twain

“Live as if you were to die tomorrow. Learn as if you were to live forever.” – Mahatma Gandhi

“Tell me and I forget, teach me and I may remember, involve me and I learn.” – Benjamin Franklin

“You don’t understand anything until you learn it more than one way.” – Marvin Minsky

“The beautiful thing about learning is nobody can take it away from you.” – B.B. King

“A man who asks is a fool for five minutes. A man who never asks is a fool for life.” – Chinese Proverb

“The whole purpose of education is to turn mirrors into windows.” ―Sydney J. Harris

“The more that you read, the more things you will know. The more that you learn, the more places you’ll go.” – Dr. Seus

“Knowing is not enough, you must apply; willing is not enough, you must do.” – Bruce Lee