# Mental toolbox to learn efficiently

An overview of mental exercises

Based on material covered in “Learning How to Learn” from Coursera MOOC (1)

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## Introduction

Learning is something which will raise different thoughts and feelings on many people. Whether it be a high school student or a lifelong learner there's always different approaches one could go for and fall into. It's sometimes difficult to put yourself into a learning mode and when you do there might be constant distractions which are keeping you from getting things done. There also can be excellent times where studying goes as planned however next time it could be difficult to repeat the process. In this small overview I try to put together key points and explanations on how to use known mental tools to assist a learner on any age.

As covered in the Coursera course by Dr. Barbara Oakley and Dr. Terrence Sejnowski a human brain is a complex organ which is responsible for almost all of our life experiences. And to learn something effectively one needs to besides mental techniques also keep his or her brain in good physical health.

## Overview of the toolbox

- learning modes – states of mind when learning
- memory types – available memory at our disposal
- brain health – chemistry and physical health behind learning
- learning techniques – various toolsets to learn more efficiently
- procrastination and automation – more tricks on getting the maximum from learning time

## Learning modes

There are two main learning modes known. First is the **focused mode**. Focused mode of learning is when a person intensively focuses or observes something closely. It can be a physical object or something abstract as some biomolecular concept. This focused mode is the main mode of learning where all the mental energy is directed towards getting or storing new information.

In focused mode of learning information is usually processed in an intense way where known ways are first tried out. It's when one is working on something familiar. Also when trying to store something into memory like a repetition is also a form of focused mode of learning.

Second is the **diffuse mode**. Diffuse mode of learning can happen in an abstract state of mind. Like when you look out of a window to a distant landscape or change of focus to something completely different from your study material. Diffuse mode can kick in also when a mind is relaxed while walking or getting a nap and even while sleeping. It can be used when working on something new. In diffuse mode new ideas and solutions can pop into your mind whereas if in focused mode only a narrow road and familiar ideas can be seen.

It's important to use both modes for an efficient learning.

## Memory types

Humans have also two main memory types available for learning. One of them is the **long term memory**. It is a place where most of the information we know can be stored. It's like a storage warehouse where space is no issue however to retrieve memory items fast, it is needed to revisit the stored material from time to time. This is also the place where fundamental knowledge is stored – everything we know about the life and our world.

Second type of memory is the **working memory**. There, only the information we currently process resides. It also holds only limited "slots" of information which is found out to be four items. Repetition is the key to hold the information there longer.

To move information from working memory to long term memory it takes time and practice. There are certain ways to let this goal be achieved - **learning techniques**. Also daily activities and brain health is a key factor on storing information in memory.

**Brain health**

Healthy mind and body is a base for learning efficiently. Positive state of mind together with balanced and working brain chemistry makes memorizing and thinking as it should be.

It's important to get **enough sleep** each night for the brain to first, clean itself from metabolic toxins. Secondly good night sleep helps to convert info from focused mode into diffuse mode to better store and understand the study material.

Moreover there are three important chemicals in brain which when balanced make up a good and healthy mind to start working with.

**Acetylcholine** which are produced by acetylcholine neurons are important in attention and focused learning. This chemical is important in building new connections for long term memory and scientists have discovered it also has profound impact on subconscious mind.

**Dopamine** is responsible for controlling our motivation factors. It also is part of a larger brain system which controls reward learning. This chemical is released when an unexpected reward is received. Certain addictive drugs can increase dopamine activity and give pleasure to mind however after effects and long term usage will lead to negative and unforeseen consequences. Anhedonia as a loss of motivation and interest in things which once have given pleasure is connected to loss of dopamine in brain chemistry. Interestingly enough if you reward yourself after study with something pleasurable you are tapping into your dopamine system.

**Serotonin** molecule is associated with social life and risk taking activity. If it's in balanced state the social life and risk taking is in healthy doses. With lower levels of this chemical violent behavior, depression and unnecessary risk taking activities have been observed.

Also important for brain health are **emotions**. It's important to experience many different types of emotions but also necessary is to put them aside to better give room for new ways of thinking and learning. Recent studies have confirmed that emotions are intertwined with perception and attention and emotions are interacting with learning and memory.

Also not far away from emotions are feelings of **stress**. While stressed your mind cannot use focus mode efficiently and that hinders learning.

It is said that change of scenery, jogging, walking, cycling are all important to positive outcome for body and so it has to for mind. Fresh air and moderate physical activity will first let your mind enter to diffuse mode, secondly free yourself from unwanted emotions to give way for fresh ideas and last but not least moving your body helps to relieve stress and anxiety. ".. physical activity improves cognitive processes and memory, has analgesic and antidepressant effects, and even induces a sense of wellbeing" (2).

**Learning techniques**

Now it's time to introduce methods of studying to learn better. These particular ways are key in storing information in a more efficient way.

**Spaced repetition** is a form of repetition where it's needed to study a learning material over a period of several days. That means from time to time you take up the study material and go over it couple of times and leave the information you have received to kind of settle into your brain. After couple of days when repeating the material again the neural connections are created stronger than when using intensive repetition in the last minute timeline (3).

**Pomodoro** is Italian for tomato and this word represents a tomato shaped timer which is used with classically a 25 minute learning session. It was created in the late 80s as a time management method by an Italian Cirillo (4). The idea is to enter into a distraction free mode and intensively focus on a study material in a particular length of time. Then the timer helps to notify when the session is over. After which it's important to take a break and treat yourself with something to let the mind know that it did good. So after practicing this technique when going into another session brain is triggered to pleasantly wait for that reward and so it can partake the pomodoro session in less distracted manner and perhaps even wait for that next learning session.

**Chunking** is a mental leap that helps to unite bits of information together through meaning. After chunking the chunks are compact pieces of information which are bound together through meaning or use. When creating a keyword like "pomodoro" behind a meaningful context is a form of chunking. Chunks can grow bigger with first hand experience and practice and accessed by a simple item (keyword, meaning, use) and can be fit into a slot of working memory.

In chunking there are more ways to assist in your learning i.e. **interleaving**. This is an idea where it's important to learn by practicing different concepts, approaches, techniques all in one session. That is mixing up learned material and trying to use familiar ideas or solutions on different subjects in life. This can lead to another term with positive outcome which is **transfer** – chunk that is mastered in one area can help to learn new chunks in different areas which seem to share commonalities.

One pitfall to all this chunking and transfer is **einstellung** (5) which is german for mindset. What it essentially means is that an initial simple thought or neural pattern already developed may prevent a better idea or solution being found.

**Illusions of competence** are keywords to an idea that there are times when you think you know a subject you have studied, i.e. when going through study material, reading and making a lot of notes with lots of highlighting without really trying to understand the essence or form a bigger picture. However because your mind sees a good notebook it can think that it knows the subject but actually without testing yourself you never really know.

There are several ways to rid yourself from this illusion of competence. First it's easy to reread something if you can't remember however to make your study time more focused and effective a **recall** approach is best used. Only time when rereading is better is when you let time pass between rereading so this exercise becomes more like a spaced repetition described earlier.

Secondly when learning new material it is good to make notes however **minimize highlighting** as this might lead to illusions of competence again. When avoiding easy stuff, testing yourself frequently by means of some simple test or recall are all ways to avoid illusions of competence.

**Index cards** are another trick to get the most out of learning session. Humans have outstanding visual and spatial memory systems that can help form part of long term memory. To begin tapping into visual memory system one needs to make a very **memorable visual image** representing one key item which need to be remembered. Image is so important to memory because it connects directly to right side of brain's visual, spacial centers. Repeating especially spaced out repetition helps to reliably store that memorable item into long term memory.

To use the index card technique (6):

1) on one side write down something you need to remember – a word, formula, year, phone number etc.

2) on another side put down the meaning and possibly a shorter description. It's especially efficient to also draw or paste on to this side some graphical image which connects all this meaning and description with that study item.

3) briefly go over the cards each morning and/or before going to sleep and over many days to take advantage of spaced out learning

**Meaningful groups** of information are yet another way to memorize study material. This is to simplify the material that needs to be remembered. Like when needing to memorize some plants. Let's say if needing to memorize three simple plants in some context one would create a 3 letter group BAT which then would stand for Basil Anise Tangerine. The more memorable and simplified the group name the better. In working memory only the group BAT is memorized. If some starting letter wont match then it's still possible to use more starting letters of a word that is simplifying. Like ROAST could stand for **Ro**oibos, **A**nise, **ST**evia.

**Memory palace technique** (7) is a form of memorization which is a powerful way of grouping things that need to be remembered. The items there can be completely unrelated which can be good for lists, visual notes, images to yet another meaning of mental chunks etc. Practicing with chunking, visual and spatial memory systems allow people to expand their working memory with easy access to long term memory.

To use this method a person needs to imagine a very familiar place in mind. Then putting memorable images and even meaningful groups into scene. Because one can recall a familiar place into mind it is lightning fast and connecting memorable images with familiar locations can happen intuitively simple. That on it's own helps to become a more creative person and with time and practice train memorization skill further.

**Procrastination and automation**

Procrastination is a term which surfaces too often on our daily lives. When something needs to be done whether it be studying, working on some project or even taking a dog for a walk then any distraction or irrelevant action which keeps us from filling the goal is a problem. Luckily there are many ways of **tackling procrastination:**

1) pomodoro (8) – the easiest and most direct way to keep focused is 25 minute sessions after which a relaxation break is necessary which can be finalized with a reward to let the brain tap into it's dopamine reserves. This signals brain that any sort of studying no matter the topic can be pleasurable and rewarding experience.

2) concentration on the **process vs product**. When process is the flow of time with the habits and actions associated with and a product is the outcome of it then it's easier to see to where the focus should go.

When something needs to get done it is the focusing on the final outcome that mostly keeps work from getting started. Because the outcome in mind seems too big or inconvenient to currently start working with. However when shifting focus from product to a process then it is way easier to set goals of 25 min of process time (working or studying time) without wasting valuable mental energy for fighting with procrastination. This helps us to start working with important things any time without stressing too much about the final outcome i.e. a product. Focusing on the process let's us start sooner and progress faster even with regular breaks.

3) It is said that effective learning is a bit by bit activity spaced out to many days, weeks and even further. That's why it's important to take procrastination into control. When starting studying earlier in a day it is easier to get going.

When talking about **automation** then habits come to mind. There are a lot of habits people do every day. Habits can be brief or long, good and bad. Good thing about them is that there is no need to think in a focused manner about doing things. This means that minimal amount of mental energy is used within those activities. This saves the energy for other more focus requiring purposes.

**Habits** can have 4 main parts:

1) the cue – a trigger that launches person into an automated mode of doing something, like getting a text message in the middle of a study session to stop working.

2) the routine – automated mode like a habit where person's brain is used to fall into when it receives a cue.

3) the reward – every habit continues to develop because it rewards us. Procrastination is an easy habit to develop because the reward moving mind's focus to something more pleasant happens so quickly and easily. Luckily good habits can be rewarded as well. Finding ways to reward good study habits is important to escape procrastination (9)

4) the belief – habits have power because they are believed in. Like when someone believes that he or she is never going to be able to start working early in a day.

**Harnessing habits** to help out in learning is done by adjusting parts of habits:

1) **the cue**. Trigger which pulls a person away from work can happen in four distinct categories: location, time, how a person feels like inner reactions to topic. Because procrastination is an automated habit it usually difficult to be aware that procrastination has started. To prevent those

damaging cues it’s needed to shut yourself off from internet, mobile phone. It helps to use pomodoro technique to not let yourself fall into bad habit.

2) **the routine**. Normally when brain falls into automated routine in this stage it’s possible to rewire old habits by making a plan. The plan can be either a spaced out learning using pomodoro and/or changing environment to less distraction free.

3) **the reward stage**. Habits are so powerful because they make neurological cravings. Investigate ways you can reward yourself. Perhaps mini deadlines like stop the work at six o’ clock or some other time. Rewarding works very well after each pomodoro session also.

4) **the belief**. Probably most important to change a procrastination habit is to change a belief that you can do it

**Final words**

As the procrastination is the most important factor in a learning path there are more things to prevent it. It’s important to focus on the processes which relate to simple habits. Habits allow you to do unpleasant things that need to be done. Moreover it’s possible to conclude the things needed to be checked when **preventing procrastination**:

1) Keeping a planner journal – it’s a good idea to keep a weekly list of key tasks and also a daily to do list. A daily todo shouldn’t consist too many items and should also have a goal finish time. If there’s no marked down todo list then the things to do are constantly reappearing in working memory slots taking up valuable mental real estate.

2) Committing yourself to certain routines and tasks each day like writing planned tasks out the night before so a brain has time to dwell on the goals. Also yourself and automated good habits get rewards – like small happy breaks for the brain to change modes.

3) Watching for procrastination cues and have a backup plan when it still happens.

4) Important to do most boring or complex tasks first in the day while deliberately delaying rewards until you finish a pomodoro session.

5) Perhaps most important is to find way to intertwine some physical activity into your learning breaks. (10)

Learning throughout the life is complex and requires a lot of effort. In the end it’s important to take fun breaks and let the brain rest before going for a new and intensive focused mode session.

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