



Learning with **delight** –  
and without **frustration**

*Use it or lose it*



# Preface



## Dear student,

what you are just holding in your hand, leafing through, studying more closely or using as a writing pad is the result of intense discussions of committed teachers

– teachers who came together in a working group to ask themselves how neuroscience can help with learning – to be more exact: to help YOU with learning.

As a brain researcher I can only confirm that everything that you will find in this brochure definitely complies with modern research results.

The brochure shows most clearly that – in order to learn best and most efficiently – you need to experiment with yourself when learning and you need to reflect on yourself as a learning person. Insofar the brochure as well as neuroscience is nothing but the means to an end: thinking about yourself and your method of learning. You may recognise the one or the other point in this brochure as something that parents or teachers have already told you, but it may have gotten lost or declared “uncool”. But – on the basis of neuroscientific arguments – the one or the other may become more comprehensible. Lifelong learning will accompany you during your whole professional life – and so, from the beginning, you ought to try and do it as efficiently as plausible.

In this sense: Enjoy reading the brochure “Learning with delight – and without frustration”

A handwritten signature in black ink that reads "Martin Korte". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Professor Martin Korte

Brain researcher at the Technical University  
of Braunschweig, Germany

(M. Korte, Professor of Cellular Neurobiology at the TU Braunschweig, author of “Wie Kinder heute lernen. Was die Wissenschaft über das kindliche Gehirn weiß”, DVA, 2009 → “How children learn today. What science knows about the juvenile brain.”)



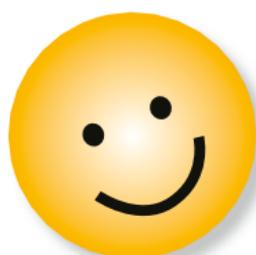
*Dear student,*

“don’t feel like it, don’t understand – I’d rather chill: Who doesn’t feel like this some time?”

Everybody can be successful! This brochure is supposed to make you think about and improve your way of studying, so you can save a lot of time and have both success and a good time.

In order to reach these goals it is important to make practising intelligent and efficient. Intelligent practise means brain-friendly practise. It is more efficient, easier and – with less effort – leads to more success.

In the centre of this brochure is the question: “What happens in the brain during the learning process? What can you learn from this for your own learning method?”



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# Knowledge beats IQ



For a long time, intelligence was considered as the decisive key to success. Learning, practising, even knowledge was underestimated.

But intelligence cannot replace missing knowledge. Most facts have to be learnt; you cannot conceive all the ideas on your own.

This is not supposed to talk intelligence down – without doubt, it has an impact on a person’s success in life. Intelligence without knowledge, however, is dead capital. Hardware without software is useless.

Modern educational research emphasises: It is of central significance to achieve a solid basis of knowledge in order to turn the gathered knowledge into a permanent possession – by revising, practising and utilising it regularly. Experts call this “intelligent knowledge”.

Educational researcher Elsbeth Stern expresses it as follows:

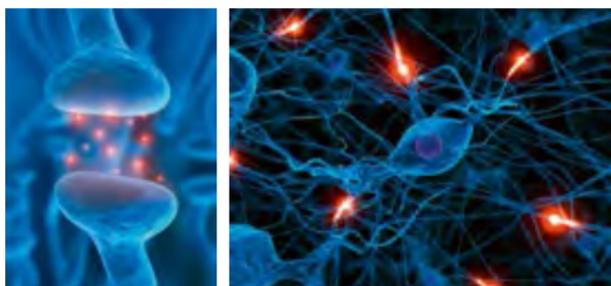
**Knowledge is the decisive key to capability.  
Knowledge beats IQ.**



# What happens in the brain during the learning process?



Learning takes place in the brain with the help of neurons (nerve cells). One neuron is connected by synapses to up to 10,000 other neurons. At a synapse, chemicals (neurotransmitters) transmit the information from one neuron to the other.



During the process of learning two scenarios must be distinguished:

1. *New links* are formed between neurons. In this process, neuronal networks are built up. New synapses are formed.
2. The synapse of an existing neuronal network is *consolidated*. In this case the contact between the neurons is intensified.

**Thus, our knowledge and skills are laid down in the brain as neuronal networks.**

A smart brain possesses strongly branched, well developed networks.



## 1. Linking neurons to neuronal networks

If you learn something completely *new*, for example a *new language*, neurons must be linked *anew*. They form a completely new neuronal net. As we all know from experience, this is only possible with a lot of effort and a high input of energy.

**Every beginning is hard.**



On the other hand, in the case of learning additional things – i.e. tying in with something already known – an existing neuronal net is extended only. Of course, this is a lot easier and needs less effort and input of energy. When a mnemonic image is formed, we unconsciously use this principle. We link something new that we want to remember to something that is already there.

As follows, someone who already knows a lot has many more possibilities for links in the brain than a person who only knows little or nothing, which means: Learning is a lot easier for him.

**That means: Learning is a self-reinforcing process.**

Briefly:

**The more is inside your brain, the more you can add to it.**

Simple rule:

**Doubling your knowledge increases your learning success four times!**

## 2. Consolidating synaptic contacts

Learning also takes place at the synapses: They are consolidated by using them – which means: by practising. Gathered knowledge thus is more solidly anchored in the brain and can be more easily retrieved.

Things that you do not use for a long time will be forgotten. We have all made this painful experience. In this case, the neuronal contacts are probably still there, but the strength of the synapse has been reduced. Renewed practising – which leads to success much faster – strengthens the synapses again.

Perhaps the following image helps you understand better: Imagine someone walks across a meadow which does not have a footpath. At first, this can be rather uncomfortable. Walking there repeatedly first creates a trail and later an easily walkable pathway. When it is not used any more, the pathway will be lost again – which is exactly the same for the things you learnt:

### Use it or lose it!

For its structuring processes, the brain needs studying phases as well as resting times (cf. The brain is active during the night). Resting times should be free from strong stimuli on the brain because these would impair the consolidation of learnt facts.

And there is something else which is important for a well-ordered storage of the learning contents: Your learning success depends on the order in which you study things. Similar things – for example the vocabulary of two different foreign languages – should not be studied successively .

*That means:*

**:: Intelligent learning needs effort**

This is valid especially for the beginning. Do not let initial difficulties discourage you.

**:: Intelligent learning needs time**

It is very helpful to have a timetable which includes studying as well as resting phases. You need to find out for yourself how long you need these phases to be. During resting times you should not expose yourself to emotionally charged stimuli as they may occur in video games, e.g. Instead, you might relax, move around a little, enjoy the fact that you have already achieved a lot.

**:: Intelligent learning needs a sensible order**

Preparing for a test or an exam is intelligent if the learning contents have already been anchored in the brain for quite a while before the date of the test – so that the gathered knowledge only needs to be activated shortly before the test.

Occasional studying before and for tests or exams does not lead to the wanted success; it is unintelligent learning – and because of this it is a waste of time and energy.

**Better practise once a day in the course of five days than five times on the same day.**



# Motivation is possible

Everybody knows what motivation is – because one sometimes has it, sometimes one doesn't.

*"I already wanted to start revising for the test two weeks ago. But somehow always something more important came up ..."*

## Which processes take place in the brain during motivation?

Our brain contains different regions which are responsible for different jobs, for example the visual centre, the auditory centre and the speech centre. There is also an area which is responsible for our motivation. It is called reward centre or centre of happiness, because it rewards us with a feeling of happiness when it is active.

When this brain area is activated, it releases the neurotransmitter dopamine, which then promotes the release of "happiness hormones" called endorphins.

## How can I activate my reward centre?

That is quite simple: It is activated by a sense of achievement. Activation is especially strong when the result is better than expected.

Thus, the feeling of happiness occurs because you have achieved something.

## What does that imply for learning (processes)?

It is important that learning leads to a feeling of success. That is why the self-defined goals must not be set too low or too high.

The inner reward gained by the sense of achievement is so strong that – in learning, too – it presses for repetition and so leads to high motivation and better concentration.

## So learning is a self-reinforcing process on the level of motivation as well.



*That means:*

**Give your reward system a chance by organising your learning (method) in such a way that your reward system starts up. So you can reward yourself without getting an "outer" reward. And the inner reward is so strong that it drives further learning processes like a motor. In this way you can avoid your motivation problem turning into a time problem.**

# Movement makes smart



In the brains of both young people and adults new brain cells are formed daily.

For the formation of new brain cells movement is a significant factor. Experiments with mice have shown that animals which move more than others form up to twice as many brain cells as their immobile fellow mice.

The same thing takes place in human beings. Furthermore, movement does not only increase the number of brain cells, but also improves brain performance. Practise and endurance lead to a stronger blood flow in the brain and as a consequence to a better supply with nutrients and oxygen. Because of this, the brain can also produce more endorphins, which are important for inner motivation and, thus, for learning.

If you do team sport, another aspect plays a role: You can only be successful together with your team members. Sometimes you need to assert yourself against your teammates, sometimes you need to support them. In this way sport helps you to achieve important abilities which are also significant for learning in a team in other contexts.



*That means:*

**:: Take care to move sufficiently during your study breaks, as movement promotes your brain development.**

**:: Perhaps you enjoy rock climbing, swimming or skating? Practise as often as possible. What about table tennis or soccer?**

# The brain is active during the night

Of all organs, the brain is the one that needs sleep most. Sleep is not only helpful for learning, it is even essential for it!

It is not sufficient for you to have learnt something – you need to consolidate the acquired knowledge. This happens mostly while sleeping. In learning experiments the recollection performance increased rapidly, as if the brain had continued practising during the night. Brain researchers explain this as follows:

- :: The actual storage only begins when we have stopped focusing on the learning contents, and it continues over a longer time period.
- :: During sleep, memory traces are transferred from the fleeting intermediate storage space of the brain – the hippocampus – into the large and safe storage space of the cerebral cortex. In this process, “tidying up” takes place.
- :: Those things that were taken up last are anchored first. That is why – in the opinion of some scientists – you can memorise learning contents especially well when you revise them shortly before going to sleep.
- :: During the processing during sleep impressions which are accompanied by strong feelings take priority. That means that an exciting computer game right before going to bed suppresses other things which have been learnt during the afternoon and were intended to be remembered.

According to present knowledge,

- :: it is difficult to balance a lack of sleep,
- :: frequently changing sleeping times inhibit the learning progress,
- :: a noisy environment during sleep and hectic activities before going to bed disturb the learning progress.

*That means:*



- :: **The brain learns longer than your consciousness, which is why we need a break after studying.**
- :: **Learning contents which are hard to memorise should be revised directly before going to bed.**
- :: **Regular sleeping times are a good basis for learning success.**
- :: **Before going to bed you should avoid all forms of excitement.**

# Attention! The brain never stops learning



As you found out in the section “What happens in the brain during the learning process?” all our experience, knowledge and skills are stored in the brain as neuronal networks. These neuronal nets and the strength of their synapses consolidated by learning determine our uniqueness: They make us what we are. As each of us has gained different experience there are no identical brains.

In addition, the brain never stops learning, neither at school nor all over the day, and no matter what you are doing. The brain cannot help but learn constantly because that is its way of functioning. Each input, whatever it may be, changes neuronal networks or the strength of synapses. If the input is repeated, the brain learns especially well.

Certainly you can comprehend the following: Watching television is the same as watching other things such as paintings or cars ... Someone who has looked at many of them interestedly knows about them, will become an expert. The same goes for watching violent movies. People watching a violent movie will learn violence. They cannot prevent this, even when they are aware of it and struggle against it. The brain just never stops learning.



Each input – not only valuable things but also rubbish – causes the formation or the extension of neuronal networks; the brain is being programmed.

The learning of violence when watching video games is much more intensive, because in this case you do not observe passively but practise actively. What enhances the whole process is the fact that you are rewarded for using violence. You gain points, reach a higher level, receive new weapons ... while in the brain the reward system is being activated, which craves for a repetition of the experience of success.

*That means:*

**Your brain never stops learning! You contribute to how your brain is programmed for your future life.**



# Alcohol makes you stupid – and so does cannabis



Someone who has drunken too much (alcohol) starts to stagger. In the same way as alcohol impairs the motoric centre of the brain, the cerebellum, it affects the whole brain.

We are especially proud of the intellectual performance of our cerebral cortex: Especially here, by the formation of new links between nerve cells, learning takes place. Because of this, new neuronal networks are formed, probably also as a consequence of the migration and integration of nerve cells.

## **What is the effect of alcohol in our cerebrum?**

- :: Alcohol “sends” newly formed nerve cells to the wrong places. They lose orientation, which can lead to disturbance of development, behaviour and learning.
- :: Alcohol reduces or completely stops the normally lifelong formation of nerve cells in the brain. Alcohol leads to an “overaged” brain.
- :: Higher concentrations of alcohol kill many nerve cells within minutes.
- :: Alcohol impairs the communication between nerve cells at synapses. It disturbs the activity of nerve cells which is precisely coordinated in tiny fractions of a second, because it causes a chaos in the neurotransmitter metabolism of all brain parts. Alcohol deletes everything that has been learnt before and causes a confusion of memory.
- :: Regular consumption of alcohol intensifies black-out reactions in stress situations.



Only undisturbed, well-coordinated activity between correctly linked neurons means to be smart.

### **And what about cannabis?**

Cannabis – especially the highly concentrated variant that is on the market today – affects the brain in a way similar to the effects of alcohol.

- :: The active substance in cannabis - tetrahydrocannabinol (THC) – disturbs the transmission of signals between neurons everywhere in the brain and in this way downright fools it.
- :: Under the influence of cannabis there is a total confusion in signal transmission.
- :: Cannabis impairs short-term memory and thus the uptake of new information by preventing the formation of new neuronal networks.
- :: Cannabis decreases the ability of logical reasoning.
- :: What is especially treacherous is this: As long as THC is within the organism, learning is impossible, even when the actual state of intoxication is long gone. Days, often weeks may pass until the effect of THC is over, and in which hardly anything can be learnt.

*That means:*

- :: Keep away from alcohol and other drugs – even in small amounts – when you want to keep your brain efficient.



# Successful learning is active learning



Learning demands dealing actively with the learning matter. If you try for learning progress by using “passive” methods, you will not have a lot of success. Passive learning is widespread – you, too, will recognise these forms: Reading new texts – underlining or highlighting – copying text sections – second reading – silent reviewing what you have read ...

As you probably have noticed, this rather passive process yields rather low rates of return in relation to a high expenditure of time.

You also know a method of active learning:

The best learning practice is active participation in class. What you need for this is solid previous knowledge. Someone who does not participate actively in class, but nevertheless expects learning progress behaves like a soccer player who remains on the sidelines during practice but expects to be nominated for the permanent team. And someone who appears in class unprepared behaves like a soccer player who comes to soccer practice without his soccer shoes. What will he be able to achieve?

New scientific studies show the effect of active learning – or passive behaviour, respectively – on the formation of the brain. By intensive use, new links between nerve cells are formed in a very short time. That means learning progress. When a new link is not used in the next few hours it is broken down again.

**“Use it or lose it.”**

So, our brain is a construction site.

Processes of formation and extension of neuronal networks are supported by taking part actively in class.

When you study at home, you can also proceed in a way that favours the formation and preservation of efficient neuronal networks and so leads to permanently better results. Try this method when working on a factual text:

1. Read the text, do not underline anything and do not copy parts of the text.
2. Read the text again, note down important technical terms as well as self-formulated questions.
3. Continue studying with just the help of your notes. Explain the technical terms aloud to yourself or to a listener and answer the questions. Thinking about the content of the text in your mind is not enough. A listener can determine well whether your explanation was easily understandable. When studying together with classmates you can use your notes for a quiz.

**Consider that only a person who can explain an issue to others has really understood it.**

4. In your notes, behind the technical term or the question, add where you found the text, e.g. B98r for Biology book, page 98, right column.

If – by trying this method – you have understood what it means to learn “actively”, you can adapt the method to your personal preferences.

In time, you will develop a feeling how to learn “actively” instead of “passively” in completely different contexts.



Use it or lose it

Intelligent learning – brain-friendly learning



Hardware without software is useless

Motivation is possible

Movement makes smart

Learning when asleep – not a dream

Attention! The brain never stops learning

Alcohol makes you stupid – so does cannabis

Learning success is addictive

Every beginning is hard

Use it or lose it

Knowledge beats IQ

Playing soccer without soccer shoes

# The German Church School and Social Project



## **Learn to be guided by your own self**

Students are very happy that they are in the German Church School and Social Project that is located in Addis Ababa, on the foothills of the Ethiopian capital's high mountain of Entoto.

The German Church School (GCS) is a school from grade 1 to grade 8 for almost 300 girls and boys from impoverished and disadvantaged neighbourhoods. They are taught by Ethiopian teachers according to Ethiopian curricula and standards.

The GCS was started and has been run by the Evangelical German-speaking Church in Ethiopia for around half a century. In 1998 the present school building was erected.

In the GCS project there are also blind and visually impaired students as well as students with multiple disabilities.

Social workers offer their support when students have difficulties at school, in their free time or in their families.

All students get a free light meal every school day. The school nurse helps making sure that the students' physical health and hygienic conditions are taken care of.

After the national exam at the end of grade 8 educational things change a little bit for students in the project. As a rule, students may stay in the GC School and Social Project and get further support in the field of social and pedagogical issues, health care, and transportation. A small pocket money helps to cover individual needs.



Students' education however, is pursued not directly on the compound of the German Church, in the German Church School building, any longer, but at various educational and pedagogical institutions: According to their abilities they pursue secondary, tertiary and vocational education at various schools in Addis Ababa, at TVET Colleges and at universities all around Ethiopia.

The GC School and Social Program gives the students a valuable chance for a responsible life in dignity in their home country of Ethiopia. This mission gets accomplished with a lot of endeavour, personal and organisational inspiration and facilities by many people dedicating their expertise, time and motivation.

The GCS program has been aiming at providing its students in an all-embracing context at primary level and opens up diversified paths to secondary or even tertiary education.

Definitely, the GCS program is a door opener for all its students who seize the opportunities that are offered and make it into a responsible and emancipated future.

These educational chances are given to the students free of school fees. Foster parents and donors primarily from German-speaking communities and countries support them right from the very beginning of their education on the compound of the German Church in Addis Ababa.

## **Melkam Edil**

Förderverein German Church School Addis Abeba e.V.

**Barbara Reske**, Chairwoman of the Melkam Edil Board

German Church School is the diaconical commitment of the German Church in Ethiopia.

For details see <https://kreuzkirche-addis.de>

# Imprint



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