



Aalto University
School of Electrical
Engineering

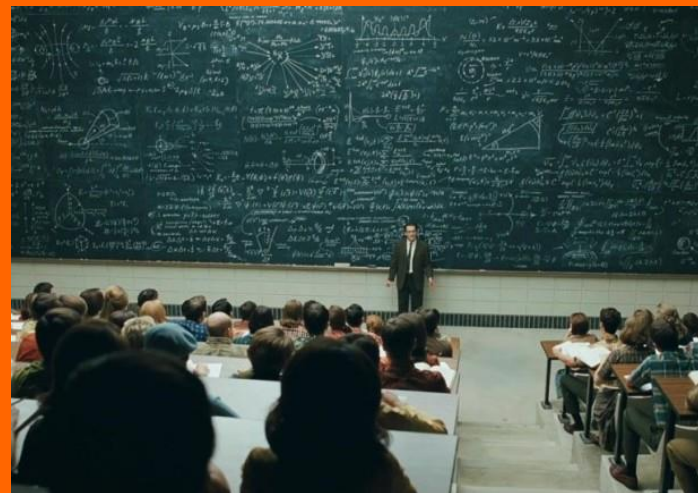
ELEC-E0110
Academic skills in Master's studies

Learning skills online workshop material 2023-2024

The material is compiled by
Sen. Univ. Lect. Jari Holopainen

Do not hesitate to contact
me regarding any topic of
the material.

jari.holopainen@aalto.fi



Abstract of the workshop

This workshop delves into the core aspects of effective learning, equipping participants with strategies to overcome common challenges encountered in university studies. Focusing on vital themes including concentration during lectures, multitasking & concentration, and difficulty of understanding, the workshop addresses how to stay engaged and absorb complex information. The participants can explore the effectiveness of different learning methods, including the age-old question of whether reading and rereading is the best approach. The choice between note taking technique, be through a computer or pen & paper, is analyzed in light of learning. Furthermore, the workshop delves into significance of embracing mistakes as learning opportunity and examines the practical implications of material issues – should it be electronic or printed? Participants can also develop the ability for systematic problem solving, honing a vital skill for academic success. Lastly, the workshop unveils the impact of participation in lectures on learning outcomes, providing insights into active engagement with educational settings. With a commitment to fostering a more enriching learning experience, this workshop equips participants with strategies to surmount challenges and cultivate effective learning practices.

Learning outcomes of the workshop

Primary goal: to elevate your learning skills such that the courses you enroll would transform into comprehensive personal and intellectual growth rather than solely pursuing credits or a degree.

In practice: learn ability to **identify** common learning-related challenges frequently encountered in university studies.

In practice: enables you to **suggest** improved learning strategies.

Disclaimer: This workshop does not teach any magic tricks, nor it is the ultimate truth. However, if you are curious and willing, it can help you to become a more effective learner. Wishing you all the best 😊, -Jari

The content of the workshop

- 1. Concentration during lectures**
2. Multitasking & concentration
3. Difficulty of understanding
4. Is the best way to learn a text to read and reread?
5. Note taking technique; computer or pen & paper?
6. Is making mistakes useful?
7. Material issues - electronic or printed?
8. Ability for systematic problem solving
9. Effect of participation into the lectures

1. Concentration during lectures

“I have noticed that my concentration drops considerably if the lecturer does not have any breaks..”

“I can stay focused the whole lecture if it interests me. Otherwise, I can lose the focus in 10 minutes or after one hour, depending on the day.”

“In basic lecture I can stay focused maybe about 2-3 minutes before I find myself daydreaming about some irrelevant stuff..”

- How long time (how many minutes) a human being can concentrate?
- Next slide: what does a study say

1. Concentration during lectures

In 1985, Burns made an interesting observation:

“A human being following **passively** can maintain concentration for just about **20 minutes.**”

→ Considering this finding, it is understandable if one’s focus wanes during a 45-minute lecture, particularly if it involves only monotonous delivery.

Moreover, this study dates back quite a bit. In today’s context of multitasking, pervasive social media use, and clickbait content, it is conceivable that our capacity for maintaining concentration might have declined even further.

The primary issue with poor concentration lies in its consequence: an inability to focus leads to inadequate learning, eventually resulting in boredom. This cycle might perpetuate a spiral of challenges.

Reference: Burns, R. A.: *Information Impact and Factors Affecting Recall*

1. Concentration during lectures

Take home:

- Prepare ahead for the lecture; it can enhance your ability to stay engaged and maintain concentration.
- Optimize your class experience by bringing along comforting items like coffee, tea, or just water
- Engage actively in class discussions; asking questions not only benefits you but also alters pace, potentially boosting concentration.
- Do not hesitate to suggest a break!
- Feel free to stand up when necessary, even though it might seem inconvenient.
- Minimize distractions, such as unnecessary use of computers or cell phones.
- Remind yourself of your purpose for attending the class; make the most of your valuable time and avoid wasting it.

The content of the workshop

1. Concentration during lectures
- 2. Multitasking & concentration**
3. Difficulty of understanding
4. Is the best way to learn a text to read and reread?
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2. Multitasking & concentration

Multitasking involves
either performing tasks simultaneously or fast
switching between a number of unfinished tasks

Can you effectively perform
multitasking?

Next slide: let us test!



Figures from:
<https://blog.buckets.co/the-myth-of-multitasking-dcd6d68fdea9>

2. Multitasking & concentration

Task 1: Count numbers in your mind: 1, 2, 3, 4, ...

2. Multitasking & concentration

Task 1: Count numbers in your mind 1, 2, 3, 4, ...

Task 2: List alphabet in your mind A, B, C, D, ...

2. Multitasking & concentration

- Task 1: Count numbers in your mind 1, 2, 3, 4, ...
- Task 2: List alphabet in your mind A, B, C, D, ...
- Task 3: List a combination of numbers and alphabet in your mind 1A, 2B, 3C, 4D, ...

2. Multitasking & concentration

- Task 1: Count numbers 1, 2, 3, 4, ... , 26
- Task 2: List alphabet A, B, C, D, ..., X, Y, Z
- Task 3: List a combination of numbers and alphabet 1A, 2B, 3C, 4D, ..., 24X, 25Y, 26Z

Did you experience frustration due to the need for "rethinking" the subsequent letter?

Next slides: what does studies say about multitasking

2. Multitasking & concentration

Mielipide | Kolumni

Olisimme tehokkaampia, jos kuormitus vähenisi

Keskeytyksistä toipuminen hidastaa työntekoa. Aivojaan ei voi opettaa monitekemiseen, vaikka niin haluaisimme.

Anu Ubaud

Julkaistu: 19.7. 2:00, Päivitetty 19.7. 9:08

KESÄLOMALLE jäädessäni tein saman kuin moni muukin. Käänsin puhelimeni sovellusten ilmoitusasetukset pois päältä. Pyyhkäisin asetuksista yksitoista työ- ja vapaa-ajan sovellusta hiljaiseksi. Päätin, etten avaa sosiaalisen median sovelluksia viiteen viikkoon.



Kuva: JUHANI NIIRANEN / HS

Samalla pyyhin seuraavista viikoistani pois mahdollisesti joitakin tuhansia kertoja, jolloin käsi ja aivot olisivat tarttuneet puhelimeen.

Keskiverto älypuhelimien käyttäjä nimittäin vilkuilee tutkimusten mukaan puhelintaan yli 200 kertaa päivässä. Syitä on kaksi: puhelin piippaa tai vilkkuu vieressä vähän väliä, ja toisaalta olemme totuttaneet itsemme siihen, että tyhjät hetket täytetään sisällöllä.

Tutkijoiden ja lääkäreiden mukaan ei ole tavatonta, että keski-ikäiset epäilevät muistisairautta, kun pääkoppa on hajamielinen eikä muisti pelaa. Dementiaan sairastumisen sijaan he ovat kuitenkin ylikuormittaneet aivonsa.

Anu Ubaud, HS 20.7.2020

Luetuimmat mielipidekirjoitukset

- 1 Kolumni** | Olisimme tehokkaampia, jos kuormitus vähenisi
- 2 Muut lehdet** | Teiden epidemian uhrin hyväksytään hiljaisesti
- 3 Lukijan mielipide** | Rekat ovat iso ongelma tieliikenteessä
- 4 Lukijan mielipide** | Rekoista on paljon hyötyä liikenteessä

Näytä lisää

Uusimmat mielipidekirjoitukset

- 2:00 **Muut lehdet** | Teiden epidemian uhrin hyväksytään hiljaisesti
- 2:00 **Vieraskynä** | Liikenneinvestoinneissa tarvitaan

We would be more efficient if the brain loading were reduced

Recovering from interruptions slows down our working. Our brains cannot be taught multitasking, even if we wanted to.

When I went on summer vacation, I did the same as many others. I turned off the notifications of my phone's apps. I swept silent in 11 work and leisure related apps. I decided not to open social media apps for five weeks.

At the same time, I wiped off my next few weeks, possibly a few thousand times, with my hand and brain sticking to the phone.

Namely, the average smartphone user glances the phone more than 200 times a day, according to a research. There are two main reasons: the phone beeps or flashes for a little while, and on the other hand, we're used filling empty moments with some content.

According to researchers and doctors, it is not uncommon for middle-aged people to suspect memory problems when the brains are continuously distracted, and memory does not work properly. However, instead of getting dementia, they have overloaded their brains.

Younger people also suffer from the workload and exhaustion of working life. Demands and pace in working life have increased, and the reasons for exhaustion are diverse and structural. But if the brains were asked, they would reply that a significant portion of the overloading is caused by the misuse of our brains.

Continues the next page!

2. Multitasking & concentration

It is not a long time ago when multitaskers were sought for expert work. Today, the term is not used in job advertisements. Brain scientists have been able to tell us for many years that a human being is not capable for multitasking. One can focus his attention only on one thing at a time and doing multiple tasks at a time means doing nothing very well or effectively.

We have learned to classify multitasking as a curse in working life, but we anyway permit disturbances and interruptions in our working culture. They seem usual, even though they simply disturb our attention in a middle of an ongoing job.

We also expect others to be able to withstand interruptions and disturbances. We get annoyed if others do reply immediately to our messages.

When a person interrupts his/her working due to an incoming call, message, or other disturbance, it may take even up to 20 minutes to get back working with the same intensity, researchers say. Thus, while efforts are being made to make working life more efficient everywhere, a large proportion of people are working rather inefficiently. A large part of a normal working day is spent reacting to various interruptions and then striving to get back to the job that one was working for.

At the same time, the brains are burdened, and instead of assumed efficiency, working slows down. In the evening, the brains are stuck, and a person blames that the workload is too high because of an overly effective working life. In fact, the workday may have been quite inefficient. When the brains constantly jump from an ongoing task to another and back, the efficiency is wasted in those leaps rather than the task itself.

Our brains cannot be taught multitasking, even if we wanted to. In HS's Teema magazine (3/2020), brain researcher Mona Moisala said that people who do several things at the same time in their normal lives, do not manage better in multitasking tasks in laboratory conditions. Quite the opposite, studies show they have a poorer ability to concentrate than others.

Today, there is also discussion on self-inflicted concentration disorder, referred to as ADT (attention deficit trait). A person has concentration problems and also a habit to interrupt him/herself, for example, by grabbing the phone. A person with impaired concentration is incapable of being systematic and is poor at managing time and prioritizing things. Many of us think that they are good in those things, and that those abilities are valued in working life.

Brain scientists have long recommended at least one hour without a smart phone per day. It would be an act of well-being for the brains and the ability to concentrate. Interruptions, being always reachable and the phone glancing often continue after a working day also at home. In HS Teema, brain researcher Mona Moisala gives an encouraging message: ability to concentrate can be trained back.

You can start by committing to that one hour without a smart phone in a day.

2. Multitasking & concentration

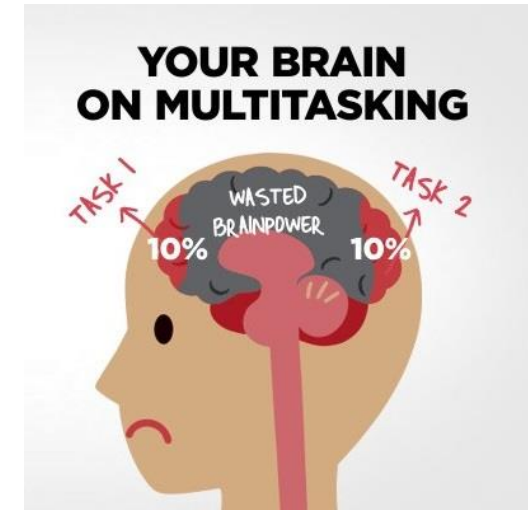
According to the study [1]: only **2%** of individuals are naturally skilled at multitasking!

Interestingly, a whopping 70% of participants believed that they were above average in multitasking ability 😊 😊 😊 [2]

The primary reason for multitasking is the **challenge of maintaining focus** on a single task [2]

Multitasking, or more commonly “switch-tasking”, can actually decrease productivity by as much as **40%** [1]. Concentrating on one task at a time generally leads to more favorable results.

Developing the skill of concentration, that is, avoiding multitasking, is something everyone should prioritize.



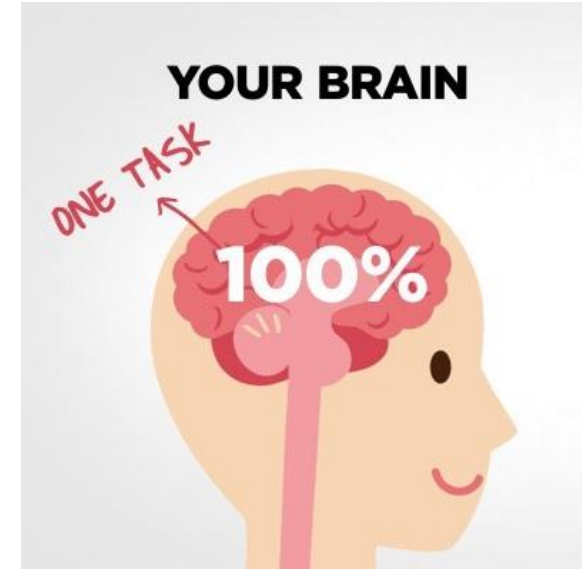
[1] Joshua Rubinstein *et. al*, *Executive Control of Cognitive Processes in Task Switching* (2001)

[2] David M. Sanbonmatsu *et. al*, *Who Multi-Tasks and Why? Multi-Tasking Ability, Perceived Multi-Tasking Ability, Impulsivity, and Sensation Seeking.* (2013)

2. Multitasking & concentration

Take home:

- the *human brains* are more effective when they can concentrate on one (complex) task for a longer time, **e.g., 25 ... 45 minutes**, followed by a proper break, e.g., 5 – 15 min.
 - Enhance your productivity by installing a work session timer app on your smart phone. While engaging work (for 25 – 45 minutes), avoid checking your phone and maintain your focus on the task until the timer signals! When it's time for a break, take a short walk, drink water or coffee/tea etc.
- Prioritize: try to finish **one** (or two) **planned task(s)** a day.
- Make sure that you get enough sleep and physical exercise, and your diet is nutritious.



[1] Joshua Rubinstein *et. al*, *Executive Control of Cognitive Processes in Task Switching* (2001)

[2] David M. Sanbonmatsu *et. al*, *Who Multi-Tasks and Why? Multi-Tasking Ability, Perceived Multi-Tasking Ability, Impulsivity, and Sensation Seeking.* (2013)

The content of the workshop

1. Concentration during lecture
2. Multitasking & concentration
- 3. Difficulty of understanding**
4. Is the best way to learn a text to read and reread?
5. Note taking technique; computer or pen & paper?
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9. Effect of participation into the lectures

3. Difficulty of understanding

”It is **frustrating** if I can’t follow the lecture fluently ...”

What factors cause ”difficulty of understanding”?

Next slides: whatever reason you find lectures and courses difficult, there are ways to overcome this. Let us see what does the science say...

3. Difficulty of understanding

Let us start with the positive: Ability for understanding is **not** (significantly) impacted by the intelligence.

However, intelligence does have some influence, yet the most substantial effects are attributed to *conscientiousness* (*) and *openness*.

→ Every individual possesses substantial potential for learning, both in terms of quantity and content. Often, one's attitude poses the greatest hurdle.

(*) conscientious individuals are diligent, motivated, organized and exhibit self-discipline while striving for accomplishment

Reference: Arthur Poropat, *Personality outsmarts intelligence at school: Conscientiousness and openness key to learning*

3. Difficulty of understanding

Another study: the students were split into **three** groups, for which the teaching was arranged the following ways:

- 1) "Traditional" one-way lecturing; teacher speaks and students listen
- 2) Traditional lecturing + teacher explains the most difficult topics based on the feedback of students' understanding
- 3) Each student has a personal tutor who helps all the time

After the final test: Group (3) had the best know-how and Group (1) was the worst, not a big surprise. Let us elaborate a bit more...

3. Difficulty of understanding

In group 3 (learning with personal tutors), the average student succeeded better than **98 %** of the students in group 1 (traditional lecturing).

In group 2 (feedback loop from students to teacher), the average student succeeded better than **84 %** of the students in group 1 (traditional lecturing)

What does this result mean?

How can you in practice try to use this **“feedback-looped learning”**?

3. Difficulty of understanding; feedback loop

Take home: fill the “holes” of your understanding

- **Engage** actively in the contact sessions and **ask** clarification when unclear; this also enables teachers to identify the challenging areas and potentially adjust the level better suit your needs.
- **Write down** questions during the lectures, and then seek answers using provided materials the next day. If uncertainties persist, collaborate with peers and/or teachers.
- Establish “**study circles**” with classmates; verify your knowledge and assist each other in addressing gaps. This collaborative approach benefits all, as teaching others is one of the most effective ways to learn 😊

The content of the workshop

- Read through the following cases and perform related tasks in each case:
 1. Concentration during lectures
 2. Multitasking & concentration
 3. Difficulty of understanding
 - 4. Is the best way to learn a text to read and reread?**
 5. Note taking technique; computer or pen & paper?
 6. Is making mistakes useful?
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 8. Ability for systematic problem solving
 9. Effect of participation into the lectures

4. Is the best way to learn a text to read and reread?

- Do you agree or do you find better ways?

4. Is the best way to learn a text to read and reread?

”I had a course in which the questions for the exam were given out in the first lecture. 15 questions were given out and 6 of those would be in the exam. The question covered all the material the course had, and by answering to all questions gave students good knowledge of the course material.

I studied the materials and answered two questions/week, by the time of the exam I had very good answers to all questions. Those who didn't answer the questions beforehand struggled in the test and performed poorly.”

What do you think? Is read and reread the best way? If not, what is?

4. Is the best way to learn a text to read and reread?

The study conducted by Karpicke & Roediger challenges this.

The most effective method of learning involves **testing oneself** and applying suitable **self-correcting** techniques.

Take home:

- Acquire knowledge by generating relevant questions and seeking answers.
- Review challenging segments and seek assistance if necessary.
- For example, when learning foreign language vocabulary, cover the words and test yourself.
- Testing provides feedback that aids in concentrating learning efforts and contributes to enduring retention.

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5. Note taking technique

“During the lecture either I take my laptop or my notebook to my desk, depending do I need to take notes or should I watch some power point or other material relating to the lecture.

“I don’t do notes during the lecture because I find that, while doing so, I tend not to understand a thing the lecturer is talking about.

Which is a better way of taking notes, “pen & paper” or “computer”?

Next slide: what does a study say?

5. Note taking technique

Kotimaa

Espoolaisopettaja teki testin ja laittoi opiskelijat kirjoittamaan muistiinpanot käsin – ”Koenumerot paranivat keskimäärin kaksi numeroa”

Aivotutkija: Käsinkirjoitetut muistiinpanot ovat luovempia.

HS 16.12.2019

Tilaaajille



Opettaja Kari Ojanen seurasi, kun Noora Kovalainen ja Inka Arnkil (oik.) tekivät historian muistiinpanoja. Arnkil kertoi, että käsinkirjoittaminen tuntuu hitaalta. ”Kirjoitan koneella nopeammin ja silloin voin keskittyä opetukseen enemmän”, hän sanoi. (KUVA: JUHANI NIIRANEN / HS)

Pauliina Grönholm HS

Julkaisu: 16.12. 2:00, Päivitetty: 16.12. 9:23



KAIKKI alkoi yhden opettajan turhautumisesta.

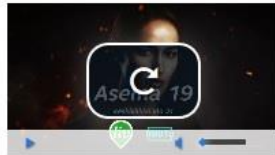
Espoonlahden lukion historian ja yhteiskuntaopin opettaja **Kari Ojanen** opetti tuolloin historiaa lukiossa Teuvalla. Opiskelijat saivat kaikki opinahjostaan käyttöönään kannettavat tietokoneet.

Pian heidän keskittymisensä tunneilla alkoi tunneilla herpaantua ja ajatus harhailla. Seurauksena näkyi oppimistuloksissa, Ojanen väittää.

Hän alkoi aprikoida, mistä herpaantuminen johtuu ja päätti tehdä kokeilun: Opiskelijat saivat yhdellä kurssilla kirjoittaa muistiinpanot, miten halusivat. Toisella kurssilla hän käski heidän kirjoittaa käsin. Aluksi opiskelijat protestoivat asiaa.

”Olen vähän oman tieni kulkija”, Ojanen sanoo hymähtäen.

TESTIN lopputulema kertoi karua kieltä: ”Koetulokset paranivat keskimäärin kaksi numeroa.”



Luetuimmat

JUURI NYT PÄIVÄ VIIKKO

1. Poliisioperaatio kemikaalivarastossa Espoon Karamalmilla, viranomaiset kieltävät alueelle menon
2. 100-vuotias puutalo vallattiin Helsingissä: ”Kytillä, natseilla ja toimittajilla” porttikielto
3. Pako jatkunut jo vuoden: Poliisi jatkaa pyöräilijän kuoleman Tikkurilassa aiheuttaneen naisen jahtaamista
4. Moni aikuinen suuttuu ja säntii, kun oma lapsi satuttaa toista – psykologi kertoo, miten oikeasti kannattaa toimia
5. Espoolaisopettaja teki testin ja laittoi opiskelijat kirjoittamaan muistiinpanot käsin – ”Koenumerot paranivat keskimäärin kaksi numeroa” Tilaaajille
6. Viron presidentti lähetti Sauli Niinistön kautta anteeksipyyntönsä, kun maan sisäministeri oli kyseenalaistanut pääministeri Sanna Marinin pätevyvyyden
7. Kiinan armeijan jättänyt mies sai kahdeksan rangaistusta ja joutui julkisesti nöyryytetyksi
8. Trump on joutumassa valtakunnan-oikeuteen – HS käy läpi, miten virkarikos-oikeudenkäynnissä voi käydä ja mitkä ovat Trumpin mahdollisuudet jatkaa presidenttinä toinen kausi
9. Tuore pääministeri Sanna Marin puolustaa hallitusohjelmaa, jota oppositio mielestä olisi pitänyt korjata hallitusvaihdoksen yhteydessä – suora lähetys juuri nyt
10. Al-Holin leirillä useita kertoja vierailut ruotsalaiskirurgi pelastaisi lapset ja veisi äidit oikeuden eteen

Espoo-based teacher had a test and told his students to write their notes – ”The exam numbers improved on average by two numbers”

It all started with the frustration of one teacher. At that time, Kari Ojanen, a teacher of history and social studies at Espoonlahti High School, taught history at Teuva. The students got laptops from the school. Soon, the students started to lose their concentration in the lessons. This was reflected in the learning outcomes, Ojanen claims. He began to think over the reason and decided to run a test: Students could take notes on one course as they wished. In another course, he told them to write by hand. At first, the students protested.

The result of the test gave a harsh fact: "Test results improved on average by two numbers."

It made the experienced teacher to think. Digitalization or the use of a computer in social science brings many sources to students and extends them beyond the book. At the same time, students become less focused and many started to browse other pages or social media. How much does hand writing improve the memory? Now Ojanen has invited us to follow his lesson at Espoonlahti High School. He would do the same test for the first-year students' course, but with two different groups of students. This lesson is about the Roman Empire. Ojanen has a creative style of teaching. Things are learned during the lesson through an assignment, where students also make notes for themselves. The task now is to put the following development factors in order: Roman government, Rise to a Leading Nation, Integrated Economic Area, and Roman conquests. Some students open a digital book, some a printed book. Form and style do not matter as such, Ojanen instructs, but no one writes the notes or tasks with the laptop, but by hand. The task is reviewed on the black board together. At the end of the course, Ojanen used exactly the same exam as the first group, who in turn wrote the notes with the laptop.

Continues on the next page!

5. Note taking technique

Of course, the experimentation is far from scientific. After all, there are two different groups of students. He wants to make students to realize the impact that handwriting has on learning. In his opinion, there is far too little discussion about learning skills.

“It sounds like an interesting experiment,” says Minna Huotilainen, a professor of education at the University of Helsinki. “Our teachers are masters to develop and apply different learning techniques.”

According to Huotilainen, handwriting and learning have a connection, but maybe not be as you might think. According to Huotilainen, several studies prove that hand writing is important for learning. It will help you to remember and memorize what you are learning better. “We know that handwriting is slower than typing. If you try to write every word quickly, it may not be the best way to take notes at all.” It is also essential for learning that handwritten notes are more lively and personal. They have various notations that indicate associations and are part of the processing of information. “They may resemble concept maps. When it comes to learning something new, it helps you to structure your knowledge into what you have already learned and what you already know,” says Huotilainen. According to Huotilainen, there is not necessarily a difference between typing or handwriting. “Of course, the laptop makes it possible to use different fonts and colors, but most people don't use them,” Huotilainen reminds. According to some studies, motor skills are easier when typing with the keyboard. They do not have the same rich sensoric experience as handwriting and therefore they form less associations to memory. But above all, the concentration can also be hampered if the mind wanders. “It's clear that it weakens learning if thoughts are constantly wandering elsewhere,” says Huotilainen.

What did the Espoonlahti high school students say about the test? This time, no one protested. Some students say that handwriting is more familiar with some subjects, but the suitable technique depends on the subject. For example, in mathematics, Alber Ahonen says that he writes notes and assignments on a computer. Mari Puolakka says that handwriting is a bit cumbersome for her, but she says that she often draws while listening the books. “Drawing calms and helps focus,” she says.

According to Huotilainen, the learning skills are emphasized especially in the high school, where individual learning skills also appear. But scientific or not, how did the test finally go? Did the exam results improve? They improved, says Ojanen. Ojanen refuses to disclose exact numbers because of the student privacy, but the group average improved by one number. “When I told others about it, many people dig up the notebooks and focus more on the lesson.” In the end, it doesn't matter how the notes are written, either by hand or by typing, concentrating is essential, Ojanen thinks.

5. Note taking technique, pen & paper or computer?

- Mueller & Oppenheimer set up an experiment in 2014:

Group 1 took notes using old-school pen & paper

Group 2 used a laptop

Both groups were tested with questions that measure 1) **memorizing facts** and 2) **understanding of concepts**

Which group performed better and why?

Reference: P. Mueller and D. Oppenheimer, "The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking", 2014

5. Note taking technique, pen & paper or computer?

Study says:

- The groups were equally good in memorizing facts by heart
- Second group with "pen & paper" was **much better** in **understanding** of concepts

5. Note taking technique, pen & paper or computer?

Possible explanations:

Pen & paper group took notes using the *own words* – i.e., constructed new information on existing knowledge and experiences

Aalto student example: “When I started my studies, I often had my computer open during the lecture because I thought that I could use it to search the internet for more information if I don't understand something. However, I quite quickly noticed that it just disturbs my concentration during the lecture.”

Take home:

- Leave your computer to your backpack and use pen & paper instead
- Consider testing so called “Cornell Notes” technique (see next page!)

Cornell Notes

Topic:		Date:
Essential Question/Objective:		
Cues:	Notes:	
Main Ideas	Meaningful Symbols	
Questions	Bullet Points	
Vocabulary	Abbreviate familiar words	
	Teacher Given Notes	
	Research Notes	
Summary:		
A thoughtful summary of key points		
A list of questions you need answered		

Cornell Note taking method:

Cue words

Notes taken in class

Key terms

Questions

Main ideas

Example: "I tested Cornell notes in my lectures. I think this is so much better than traditional note taking techniques, not to mention a computer that only distracts. Now I can much better organize my notes, ideas and know-how. I also reflect my earlier knowledge related to the topic. My sincere recommendation!"

Summary

If you select this case, return your Cornell Notes too!

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1. Concentration during lecture
2. Multitasking & concentration
3. Difficulty of understanding
4. Is the best way to learn a text to read and reread?
5. Note taking technique; computer or pen & paper?
- 6. Is making mistakes useful?**
7. Material issues - electronic or printed?
8. Ability for systematic problem solving
9. Effect of participation into the lectures

6. Is making mistakes useful?

IT'S OK TO MAKE MISTAKES.

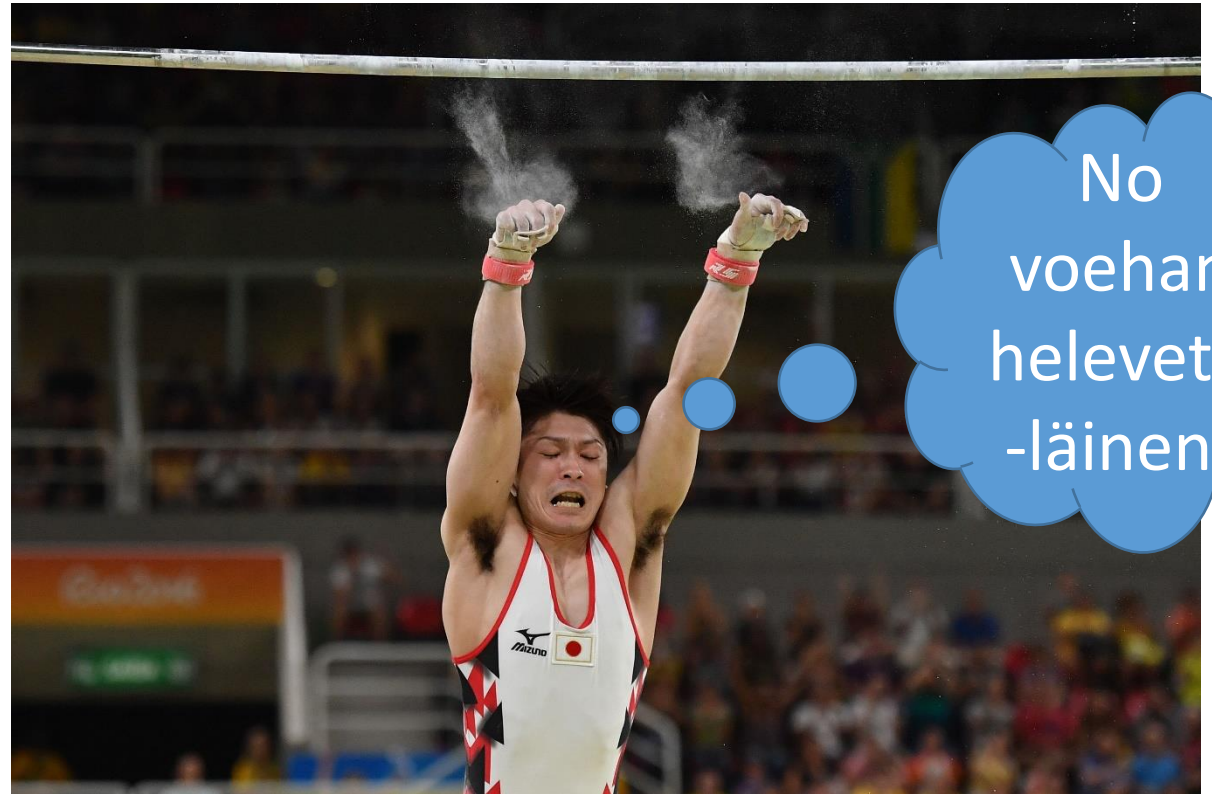


6. Is making mistakes useful?

Do you agree?

Are all mistakes equal?

What kind of mistakes can be sorted out?



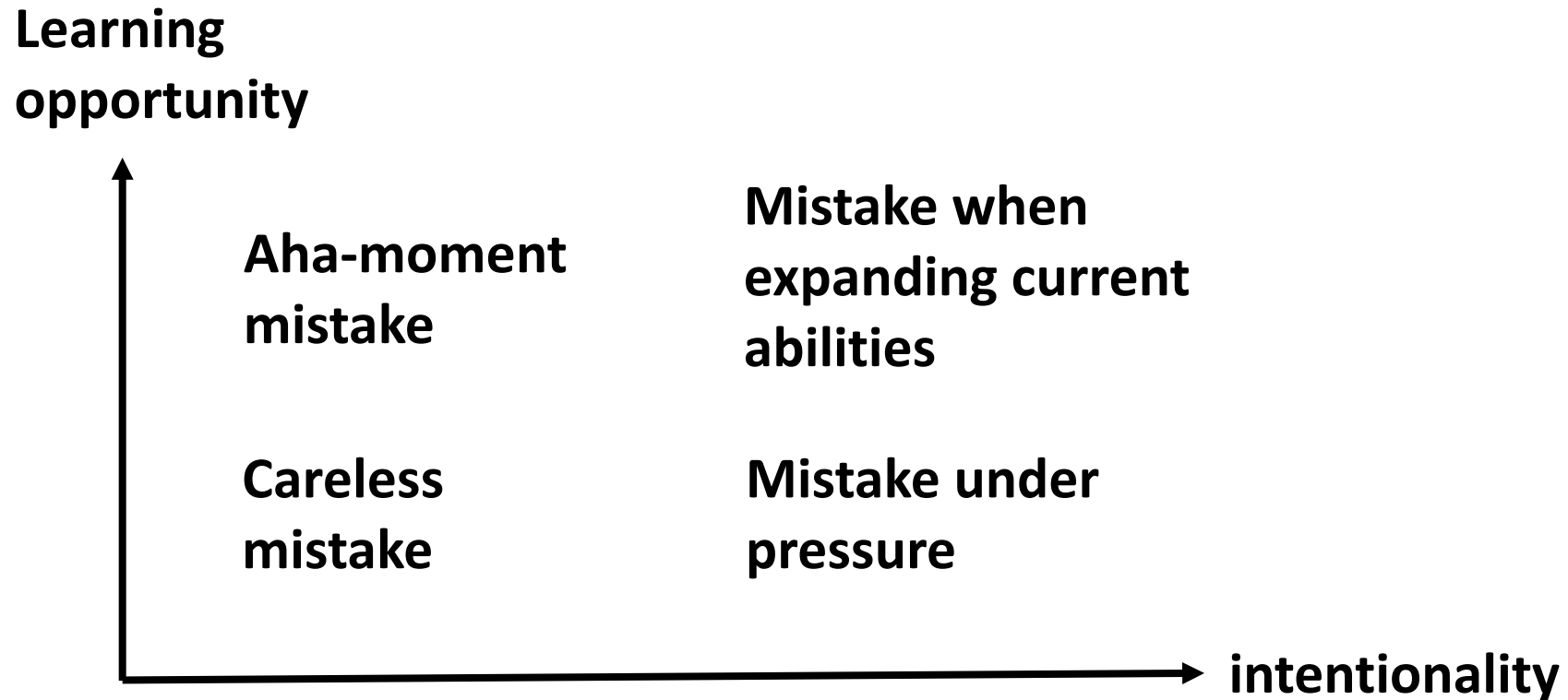
No voehan helevetti-läinen!

6. Is making mistakes useful?

Mistakes vary in significance and are not always intentional. It could be valuable to analyze the nature of the mistake and its implications.

- Learning from mistakes does not happen automatically → reflect the error, extract lessons, and develop ability to self-correct!
- Enhancing our understanding of mistakes aids in overcoming the fear associated with them, empowering us to take calculated risks.

6. Is making mistakes useful?



Reference: Eduardo Briceño, *Mistakes Are Not All Created Equal*, Mindset works (2015)

6. Is making mistakes useful?

Why did that happen?

My initial assumption was wrong but now I get it.

What went well and what did not?
What can I do better next time?



Is my approach correct?
Should I take a new strategy?

Is the goal too far beyond?
Should I adjust the goal?

Learning opportunity

Aha-moment
mistake

Mistake when
expanding current
abilities

Mistake under
pressure

Careless
mistake

I want to minimize
all risks

Ups, I lost my
grip; luckily, I
have the safety
cable.



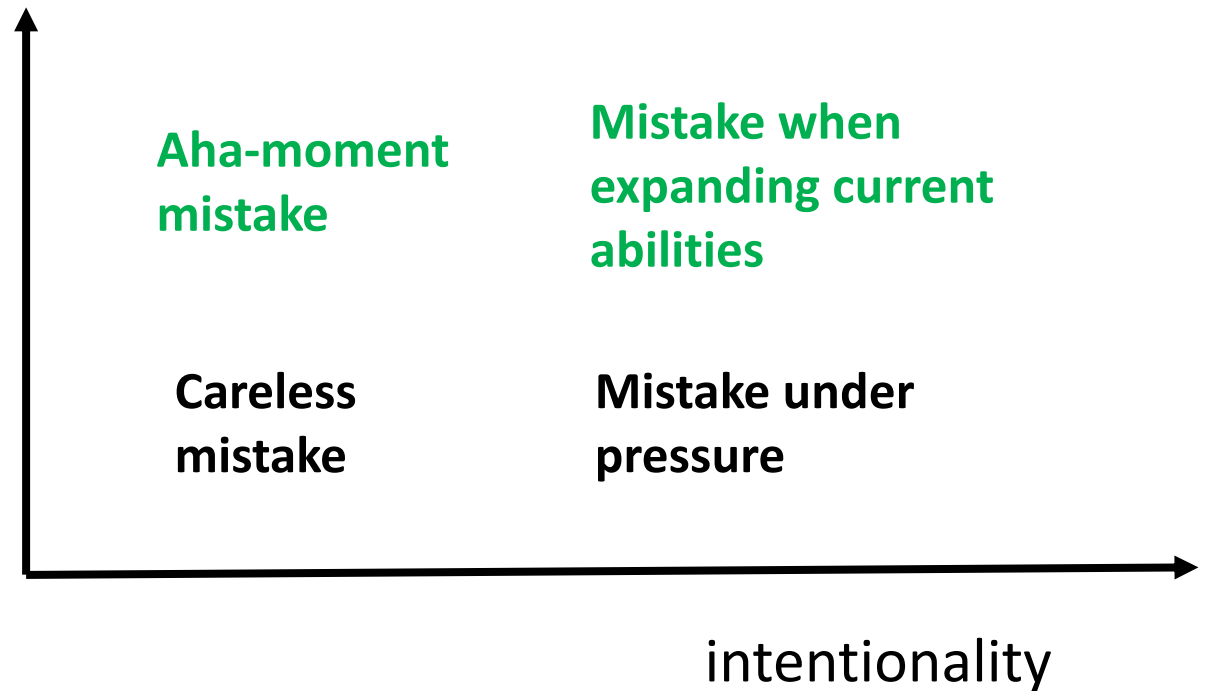
intentionality

6. Is making mistakes useful?

Take home:

- Consider your studying learning cases and ponder what kind “mistakes” took place in your daily activities.
- What can you learn from your “mistakes”?
- If your mistake wasn’t “useful” (e.g., a careless mistake), how can you avoid such unnecessary mistakes in the future?

Learning
opportunity



The content of the workshop

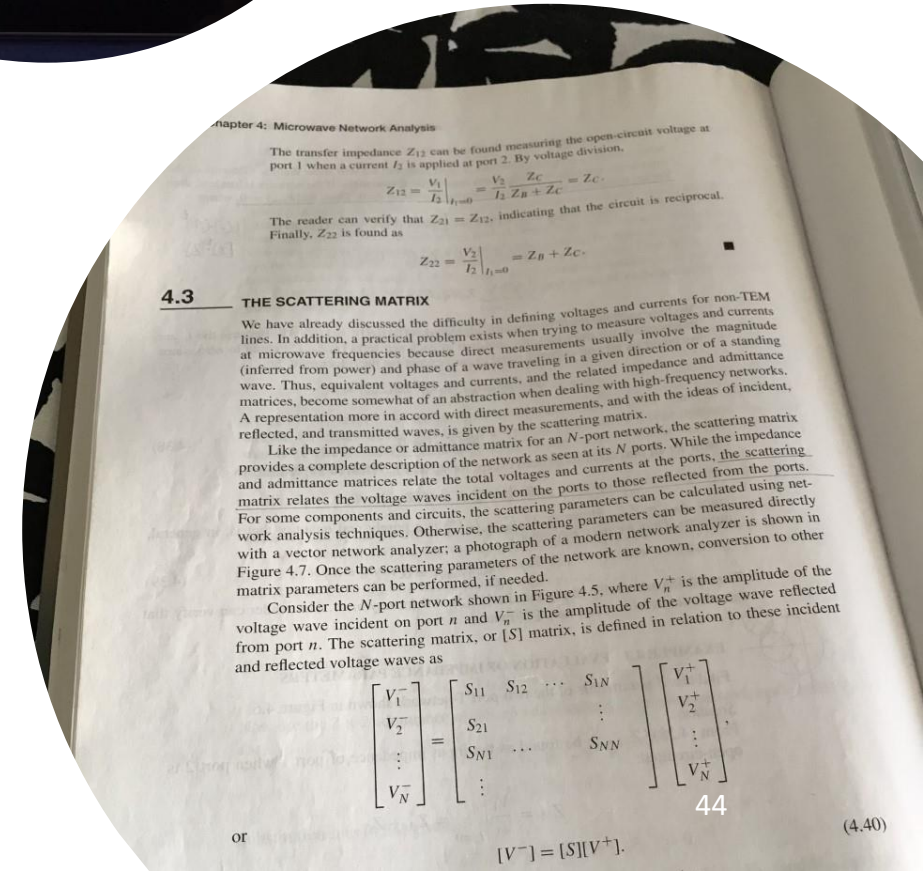
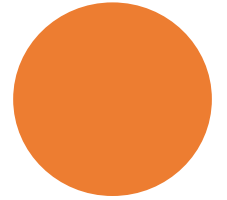
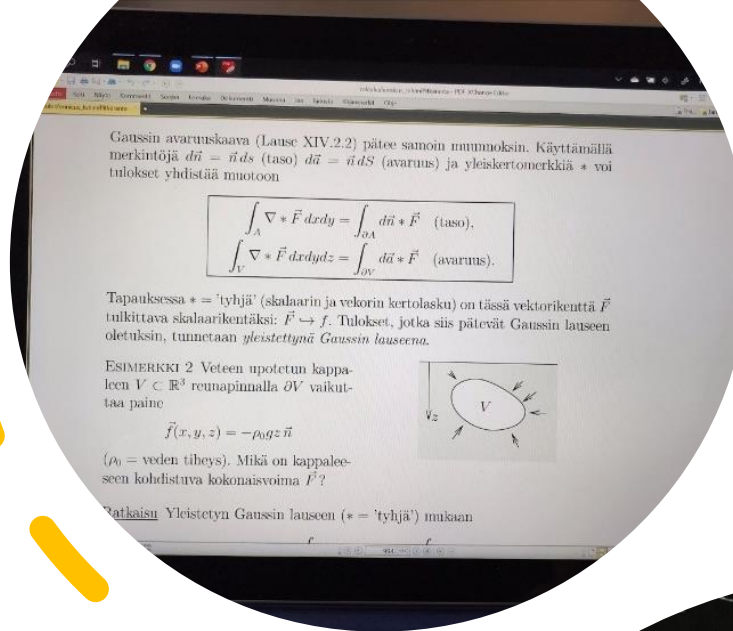
1. Concentration during lectures
2. Multitasking & concentration
3. Difficulty of understanding
4. Is the best way to learn a text to read and reread?
5. Note taking technique; computer or pen & paper?
6. Is making mistakes useful?
7. **Material issues - electronic or printed?**
8. Ability for systematic problem solving
9. Effect of participation into the lectures

7. Material issues - electronic or printed?

Which is better source of information: digital material or traditional printed books?

What do you think? Which one do you prefer?

Next slide: what does a study say?



7. Material issues - electronic or printed?

Students typically gravitate towards modern technologies such as computers, tablets, smartphones due to their accessibility and portability. “Digital natives” often find online reading faster compared to print.

Additionally, many students believe that these new technologies lead to improved learning.

But is it really true? **What does a study say?**

Reference: Lauren M. Singer and Patricia A. Alexander, “Reading on Paper and Digitally: What the Past Decades of Empirical Research Reveal,” in *Review of Educational Research* December 2017, Vol. 87, No. 6, pp. 1007 –1041

7. Material issues - electronic or printed?

A study straightforwardly concludes that **traditional printed books hold an advantage**.

New technologies do **not** necessarily result in improved learning.

The study finds that students can better grasp **complex** information from printed books compared to screens.

This is attributed to significantly higher **engagement** level with printed materials.

Take home: The more you read printed books, the better and quicker you absorb intricate information!

7. Material issues - electronic or printed?

Hyvinvointi | Elämä

Superlukijat lukevat jopa 500 sanaa minuutissa ja ymmärtävät kaiken – Miten sellaiseksi tullaan?

Lukunopeuden kannalta ei ole suurta väliä, lukeeko tekstiä ruudulta vai paperilta, mutta lukemansa ymmärtää paremmin, kun sen lukee paperilta.

♦ Tilajille

Helsingin Sanomat 8.10.2022



Näyttöruudun lukeminen on silmille vaativampaa kuin paperin lukeminen. Ruudulta lukiessaan ihminen räpyttelee vähemmän, mikä voi johtaa silmien kuivumiseen ja isompaan fysiologiseen rasitukseen. KUVA: VILLE MAALI / HS

Anna Sievinen HS

8.10.2022 7:00

VOIKO lukunopeutensa tuplata? Jos oppii hallitsemaan silmänliikkeitään, tuleeko superlukijaksi? Sellaiseksi, joka ahmaisee kirjan vauhdilla?

Voi, jos uskoo pikalukutekniikoiden mainoksia, joissa luvataan tekniikoiden parantavan silmän tarkan näön alueen käyttöä.

Super readers read up to 500 words per minute and understand everything – How does one become like that?

In terms of reading speed, it does not make a big difference whether you are reading text on a screen or on paper, but one understands better when reading it on paper.

Is it possible to double your reading speed? Does mastering eye movements turn you into a super reader? Someone who can devour a book quickly?

Yes, if you believe the advertisements for speed-reading techniques that promise to enhance the use of precise vision area of the eye.

Not possible, if you believe University lecturer Tuomo Häikiö, who conducts research on reading, reading development, and eye movements at the University of Turku.

The area of precise vision can accommodate about 7-8 letters at a time, along with the shapes of surrounding letters and spaces. Physiologically improving it is not possible.

"In speed-reading advertisements, it is often promised that a person can learn to read quickly and understand everything they read. That is impossible," Häikiö says.

Even though the area of precise vision is limited, a skilled reader learns to leverage the regularities of language, Häikiö explains. The brain can predict upcoming words.

"If, for instance, there is an adjective in the text, the brain can infer that the next word is likely be a noun. This is often unconscious processing that speeds up text comprehension."

Continues on the next page!

7. Material issues - electronic or printed?

Speed reading caused a small-scale boom in the last decade. However, the boom dwindled subsequently due to research results not providing favourable evidence for the techniques. On average, people read 200-300 words per minute – though Häikiö points out the studies were conducted on university students, who are typically skilled readers.

Super readers read up to 500 words per minute and still comprehend everything they read. We don't know what extend this is due to innate cognitive capacity. Cognitive abilities refer to information processing, such as memory, attention, and learning.

In practice, the only way to improve reading speed is by reading more," Häikiö explains. The more you read, the broader your vocabulary and knowledge become. "When you already have a foundation of knowledge, it becomes easier to connect new pieces of information to it."

Reading speed develops already in childhood. When the reading of schoolchildren has been studied, differences have been found in reading speed and text comprehension. "A faster reader is usuall an all-round better reader, meaning they also comprehend the text better."

According to Häikiö, reading speed is significantly influenced by childhood experiences with reading. For instance, if one has read aloud in the class and struggled with words, they might not feel inclined to pick up a book anymore.

"In terms of reading speed, it does not make a big difference whether you are reading from a screen or from paper," Häikiö explains. "However, we typically spend slightly less time reading from screen."

Texts under 500 words are equally memorable whether they are read from a screen or paper. When the text exceeds 500 words, differences start to emerge. According to research, people comprehend what they read better when they read from paper. "One possible explanation, according to Häikiö, is that the brain operates in a different 'mode' when a person reads on a screen."

Continues on the next page!

7. Material issues - electronic or printed?

“We often read short news articles and social media updates from screens. We skim and swipe to new images and stories,” he says. “Even if there is important information on the screen that should be read more thoroughly, our brains might naturally switch to an easy reading mode, which affects the depth of understanding.”

Another possible explanation for why we better internalize information from paper is related to what’s called a mental map. “When I was younger and took exams, I remembered where in the book I could find information. When reading from screen, we are constantly scrolling, which does not create the same kind of mental map in the brain.”

“When reading from a screen, we might have less working memory available for understanding the text.”, Häikiö ponders. “Part of the working memory is allocated to keeping up with the movement of the screen.”

Speed reading is essentially skimming through text, which provides a rudimentary understanding. Words are skipped, and the faster the speed, the less information is retained in memory. In-depth comprehension of text demand focus and the activation of reading-related processes, such as critical analysis.

“Simply underlining the text does not help internalize the content, as drawing a line is not a form of deep text processing.”

On the other hand, if you write notes in the margin or draw a relevant picture, you reshape the text and deepen your understanding.

Textual comprehension can also be enhanced by paying attention to headings, Häikiö suggests. “Surprisingly many people do not read subheadings”.

In non-fiction books, according to Häikiö, the text and paragraphs are generally structured in the same way: the core of the topic is usually found in the first and last sentences of a paragraph, while rest provides elaborative information.

“For understanding, the essence of the text is more important than the details. Text is best internalized by selectively revisiting the text, meaning reading headings and the key sentences multiple times.”

The content of the workshop

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- 8. Ability for systematic problem solving**
9. Effect of participation into the lectures

8. Ability for systematic problem solving

Which answer is better in terms of learning?

Handwritten notes on grid paper showing derivations for electric field and vector calculus.

Top left: $P=UI$, V_A , $F=mg$, $w=Fs$, $E = \frac{10^6 \text{ V/m}}$

Top right: $F = \frac{1}{4\pi\epsilon_0} \frac{q_1 q_2}{r^2} = \frac{1}{4\pi\epsilon_0} \frac{AVs}{r^2}$

Middle left: $E = \frac{q}{4\pi\epsilon_0 r^2} \hat{r}$, $E = \frac{1}{4\pi\epsilon_0 a^2} \int_{\pi}^{2\pi} \frac{\rho_l \cdot d\vec{l}}{r^2}$

Middle right: $d\vec{l} = \hat{r} dr + \hat{\phi} d\phi$, $\int_{\pi}^{2\pi} \frac{\rho_l (\cos\phi \hat{x} - \sin\phi \hat{y})}{r^2} d\phi$

Bottom left: $\cos\alpha = \frac{z}{r}$, $a \cos\alpha = z$

Bottom right: $E = \frac{\rho_l}{4\pi\epsilon_0 r^2} \int (\cos\phi + \sin\phi) d\phi$

Handwritten notes on grid paper showing transmission line theory derivations.

1.1

a) In transmission line theory, the length of the line is a considerable fraction of the wavelength or many wavelengths.

b) General forms for the voltage and current are

$$V(z) = V_0^+ e^{-\gamma z} + V_0^- e^{\gamma z} = V_0^+ e^{-\alpha z - j\beta z} + V_0^- e^{\alpha z + j\beta z}$$

$$I(z) = I_0^+ e^{-\gamma z} + I_0^- e^{\gamma z} = I_0^+ e^{-\alpha z - j\beta z} + I_0^- e^{\alpha z + j\beta z}$$

The terms having $e^{-\gamma z}$ represent the wave propagating to the positive z-direction and having peak voltage V_0^+ and peak current I_0^+ . The latter term represents the wave propagating in the negative z-direction (i.e. the reflected wave) and having peak voltage V_0^- and peak current I_0^- .

c) Characteristic impedance describes the ratio of the voltage and current on the line, $Z_0 = \frac{V_0^+}{I_0^+} = \frac{R + j\omega L}{G + j\omega C}$. It is a property that depends of the characteristics of the line, e.g. geometry and material. In this case:

$$Z_0 = \sqrt{\frac{R + j\omega L}{G + j\omega C}} = \sqrt{\frac{1 \frac{\Omega}{m} + j 6 \cdot 10^9 \text{ Hz} \cdot 0,75 \cdot 10^{-6} \frac{H}{m}}{0,001 \frac{S}{m} + j 5 \cdot 10^9 \text{ Hz} \cdot 300 \cdot 10^{-12} \frac{F}{m}}} \approx 50 + j 0,01 \Omega$$

d) This is a low-loss line, i.e. $R \ll \omega L$ and $G \ll \omega C$, so we can use the following approximation:

$$\gamma = \sqrt{(R + j\omega L)(G + j\omega C)} \approx j\omega \sqrt{LC} \sqrt{1 - j \left(\frac{R}{\omega L} + \frac{G}{\omega C} \right)} \approx j\omega \sqrt{LC} \left[1 - \frac{j}{2} \left(\frac{R}{\omega L} + \frac{G}{\omega C} \right) \right]$$

So the attenuation constant is approximately

$$\alpha = \text{Re}\{\gamma\} \approx \frac{1}{2} \left(R \sqrt{\frac{C}{L}} + G \sqrt{\frac{L}{C}} \right) = \frac{1}{2} \left(1 \frac{\Omega}{m} \sqrt{\frac{300 \cdot 10^{-12} \frac{F}{m}}{0,75 \cdot 10^{-6} \frac{H}{m}}} + 0,001 \frac{S}{m} \sqrt{\frac{0,75 \cdot 10^{-6} \frac{H}{m}}{300 \cdot 10^{-12} \frac{F}{m}}} \right)$$

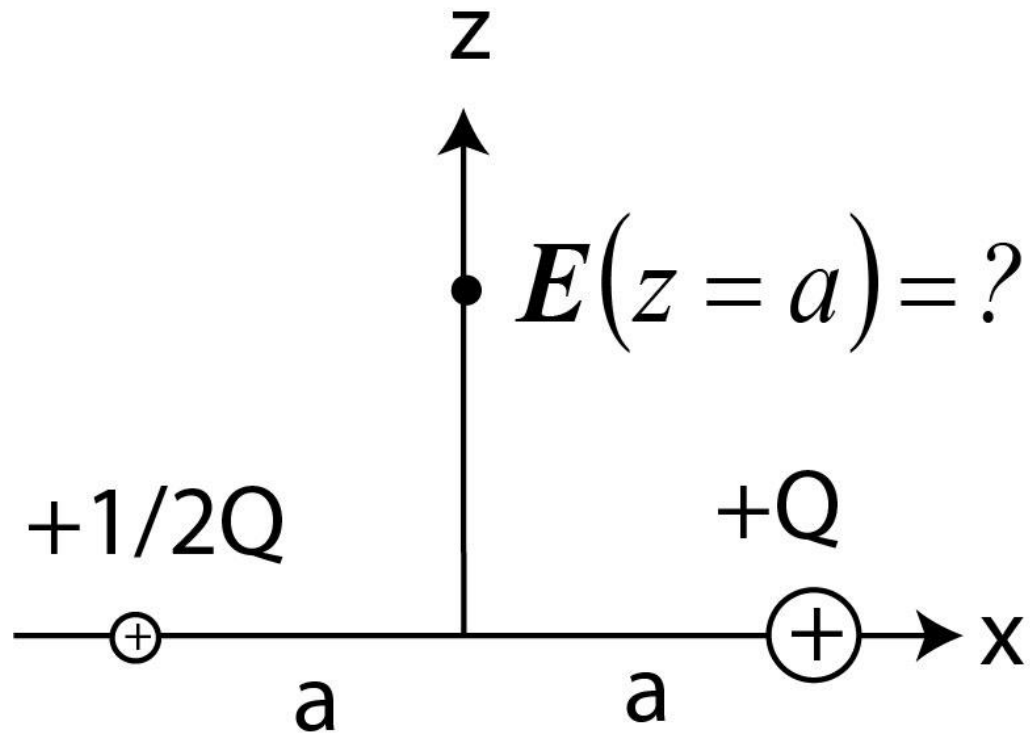
$$= 0,035 \frac{Np}{m} = 0,035 \cdot 20 \log_{10} e \frac{dB}{m} \approx 0,304 \frac{dB}{m}$$

e) If there are no resistive loss, i.e. $R=0$ and $G=0$, then

$$Z_0 = \sqrt{\frac{j\omega L}{j\omega C}} = \sqrt{\frac{L}{C}} = \sqrt{\frac{0,75 \cdot 10^{-6} \frac{H}{m}}{300 \cdot 10^{-12} \frac{F}{m}}} = 50 \Omega$$

8. Ability for systematic problem solving; example

Original task: calculate the electric field vector in location $z = a$.



Final answer on the last slide.

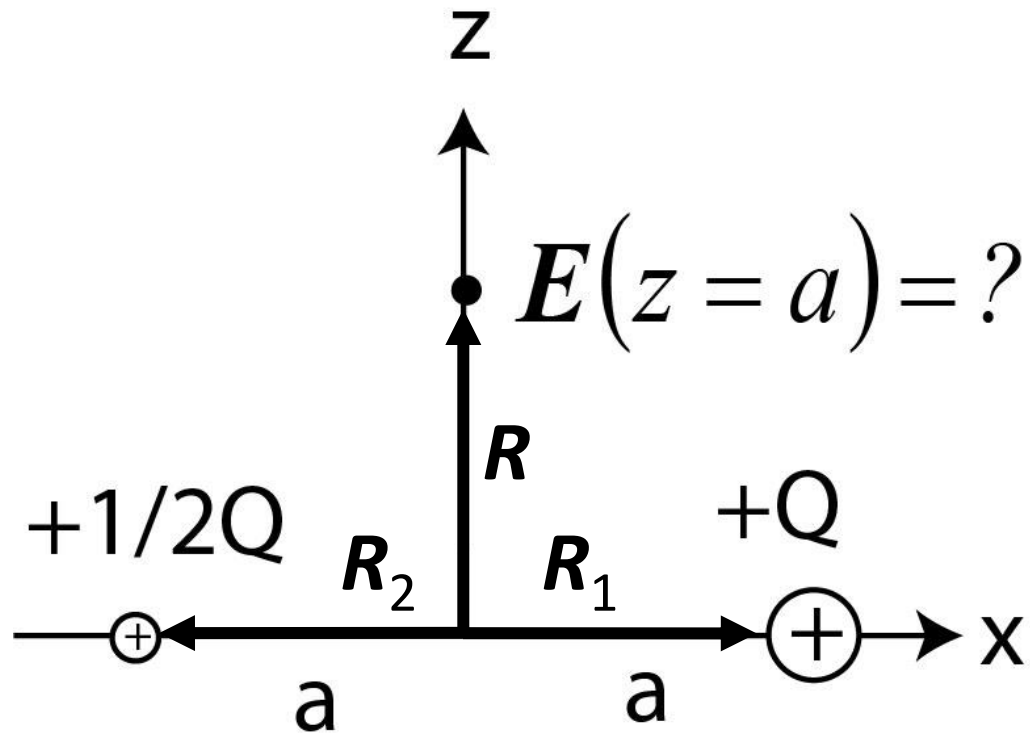
Start by thinking what is the earlier knowledge of yours that match with this problem.

8. Ability for systematic problem solving; example

Original task: calculate the electric field vector in location $z = a$.

Electric field of multipole charges (q):

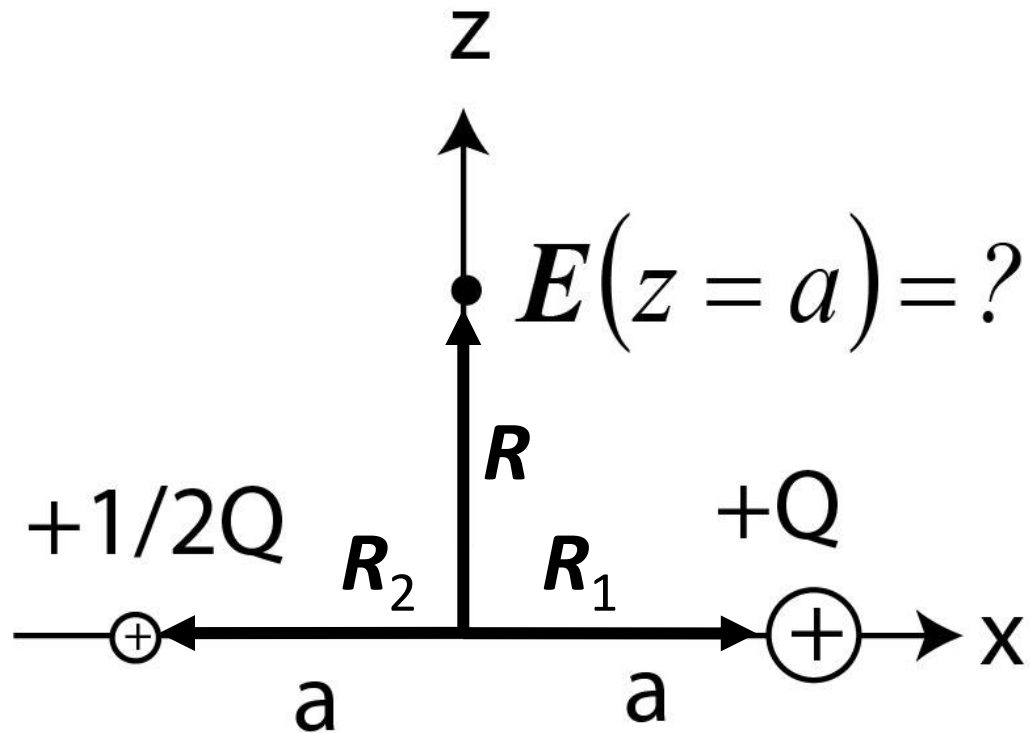
$$\mathbf{E}(z) = \frac{1}{4\pi\epsilon_0} \sum_{i=1}^2 \frac{q_i(\mathbf{R} - \mathbf{R}_i)}{|\mathbf{R} - \mathbf{R}_i|^3} = \dots$$



Try to explain the used formula based on your earlier knowledge. For instance, which known (?) formula it resembles?

8. Ability for systematic problem solving; example

Original task: calculate the electric field vector in location $z = a$.



Final answer of the task:

$$\mathbf{E}(z) = \frac{1}{4\pi\epsilon_0} \sum_{i=1}^2 \frac{q_i(\mathbf{R} - \mathbf{R}_i)}{|\mathbf{R} - \mathbf{R}_i|^3} = \dots = \frac{Q}{4\pi\epsilon_0} \frac{3\hat{z} - \hat{x}}{4\sqrt{2}a^2}$$

Analyze the result;
does it make sense in the light
of your earlier knowledge?
Are the units of the answer
correct?

8. Ability for systematic problem solving

Take home:

- Explain the used variables and give their units, e.g., E = electric field, unit V/m
- Sketch a simplified picture of the situation, mark the variables, dimensions, vectors etc. to the figure
- Justify the applied principle or theory physically and explain how they relate to the given problem
- Give a source of information, especially if it is other than the course book
- Let your solution to proceed systematically and explain the main principles so that it is evident how the final answer has been achieved (this helps especially when solving complex problems)
- Write all the intermediate steps of a mathematical solution clearly. Give assumptions you use.
- Make sure that the unit of the formula and the final answer is correct.
- Ponder whether your final answer makes sense. Justify the answer based on physical understanding of the problem (typical problems have a simplified connection to the real world).

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- 9. Effect of participation into the contact teaching**

9. Effect of participation into the contact teaching

Is individual studying more effective way to succeed in academic career than attending lectures?

What do you think?

Next slide: what does a study say?

9. Effect of participation into the contact teaching

Many studies say that **students attending classes perform better** on the assessment than those skipping classes.

Class attendance has shown to be **positively correlated** with the academic performance, social interactions and employment across a wide range of disciplines.

On the other hand, in some studies no significant correlation was found. Hence, the phenomenon is not fully unambiguous.

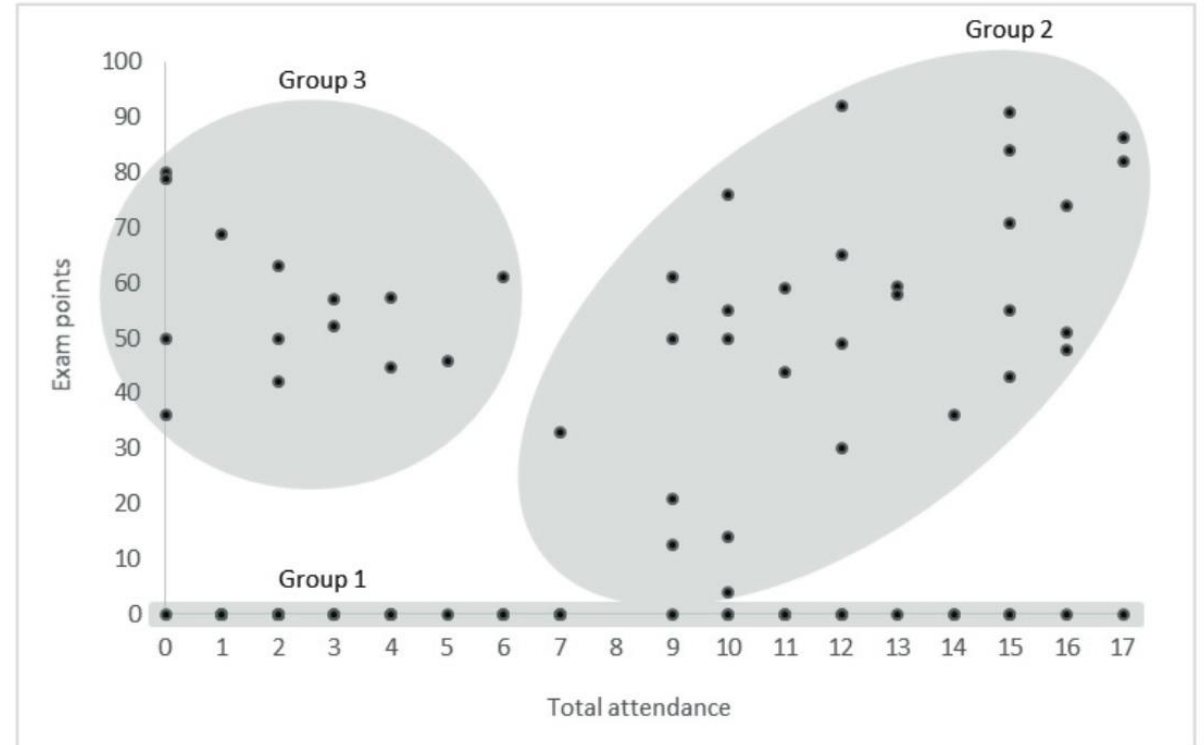
Source: Alma Spaho & Majlinda Godolja, *Lecture attendance and success on general mathematics*.

9. Effect of participation into the contact teaching

The topic was studied in Aalto University School of Business. Three distinct groups were identified in the results:

- 1) those who **dropped out** before the final exam
- 2) those who **attended classes** and the final exam
- 3) those who **studied independently** and attended the final exam

(Attending classes was not mandatory.)



Source: Anna Lukkarinen, Paula Koivukangas & Tomi Seppälä, *Relationship between class attendance and student performance*.

9. Effect of participation into the contact teaching

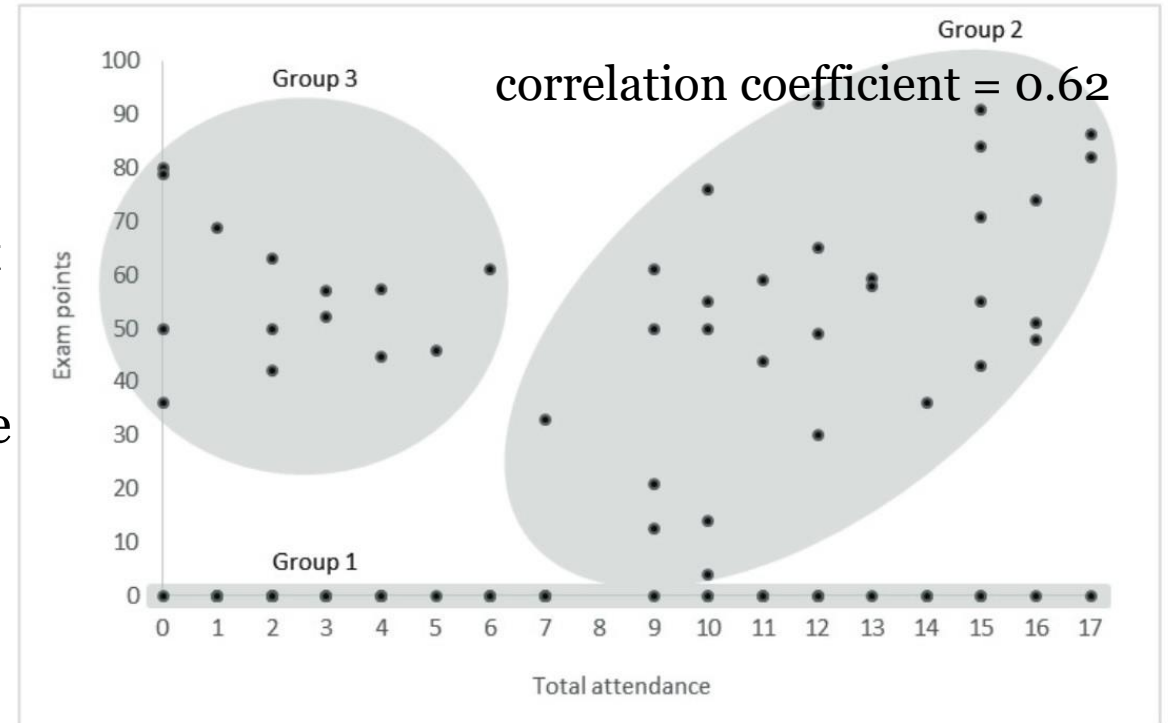
Group 2: attending classes has a **positive effect** on the exam results

Group 3: lonely riders were successful in exam, but they were identified put a **significant extra effort** for studying

Take home: self-studying is possible but make sure that you have **considerable** amount of

- discipline,
- ability for self-planning, and
- ability for external information and additional material finding,

(and be aware of the fact that you may lose a possibility for social intercourse).



Source: Anna Lukkarinen, Paula Koivukangas & Tomi Seppälä, *Relationship between class attendance and student performance*.

Conclusive remarks

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

- Nearly anything can be learnt with the right approach! Often, the primary obstacle is one’s own attitude.
- Mastering learning skills is essential in the rapidly changing world. It could very well be the sole skill that you will need in the future.
- Efficient learning skills is not rocket science, and discovering new knowledge can be incredibly intriguing!
- You can start implementing this today:
 1. **Engage with printed books.** They provide a mental workout for your brain. Reading is the unparalleled source of new information and enhanced cognitive abilities.
 2. **Share your knowledge with others.** Research suggests that teaching is the most effective method of enhancing your own understanding.
 3. **Prioritize breaks and minimize cognitive load.** The brain requires time to rest and process new information effectively. Avoid multitasking to enhance focus.
 4. **Ensure sufficient sleep, maintain a nutritious diet, and engage physical activity.** These practices have a positive impact on brain function and overall well-being.