Open and Subjective Curriculum
08

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Contents

1 Introduction

This document is a summary based on my experience as a Mentor at the Milestone Institute, as a former high school student at a Hungarian school in Slovakia, and University student at BME and ELTE in Budapest. (I graduated as a Theoretical Physicist, and currently work at Wolfram Research.)

Hopefully, this document will be helpful not only for those, who have similar interests to me, but it can bring us one step further towards a society, where more experienced people share their knowledge with younger ones, and where quality education is a shared value and a social enterprise.

1.1 Acknowledgement

I am deeply grateful to my friends and colleagues for encouragement and relevant contributions: **Anita L. Verő, Dávid Komáromy, Ye In Oh, et al.** This work would be much more biased and partial without their different viewpoint and knowledge.

2 General

Online courses on high school level in English

- Crash Course
- Khan Academy
- BBC bitesize (brief summaries of general subjects/concepts)

Online materials in Hungarian

- zanza.tv (not all subjects)

- Videotanár private tutoring style high school material
- M5-Érettségi (High school final exams (érettségi) preparation)

A general University level introductory series is the Very Short Introductions (not free to access)

Online University level course

- Coursera
- edX
- MIT OpenCourseWare
- Yale Online (their Youtube channel: YaleCourses)

Hungarian University level lectures

- BME
- Academic lectures (in a non structured form)

3 Using the Internet

The internet is an inevitable source of knowledge and information, so it is essential to know how to use it effectively.

First of all, I would highlight a short course: How to navigate digital media on Crash Course. It talks about the essential features of Online Media.

Wikipedia is a surprisingly good starting point to gain information. (A nice way to listen to the ongoing creation of Wikipedia can be found here.)

Although, Wikipedia is a good starting point, and can give an overall picture, it is important to be able to follow the references, which are provided at the end of the articles. These are usually books and/or scientific articles. [1]

It is usually possible to access these materials, however, one has to take ethical and practical considerations into account as well. These materials are accessible mainly by violating copyrights and/or paywalls. This is not only legally questionable, but one has to think about the sustainability of quality knowledge and content making. Copyright can be debated (see also here, here and here (here)), but it is part of the Human Rights (Article 27), and is implemented in USA, EU and various national legal systems. Copyright and Intellectual Property rights play an important role in financing content creators, which means, that if one accesses quality contents without paying a contribution, then the financial support of the creator should be made in some another way. Patreon is a possible way to support content creators, which can produce free and quality content, however the distribution of financial support for authors is still a challenging problem (buy a coffee and Liberapay are further alternatives), which still needs creative problem solvers in the future.

[1] Other encyclopedia type sites, which I would mention are: Encyclopædia Britannica, Scholarpedia, encyclpedia.com and for philosophy Stanford Encyclopedia of Philosophy.

After these legal, ethical and financial comments, I would like to mention three sites to access scientific books and articles: Sci-Hub for papers under paywall, Library Genesis for books, and Z-Library as a general shadow library.

On the internet credibility of a source is key, which should be determined. In case of scientific articles the Journal where they appeared is an important indication of their credibility. In general, peer-reviewed articles are considered more reliable than non peer-reviewed ones. Some most popular scientific journals are: Nature, Science, Plos One, Phys. Rew. (There are some sites, where quality non peer-reviewed content can be found. The main example is arXiv, other mentionable preprint servers are HAL and bioRxiv.) To check the background of an unknown scientific journal SCImago is a good starting point.

Another obvious starting point to gain information from is Google, however, there are many operators which can be used to search more effectively. An alternative to Google is DuckDuckGo, which lists different sites, and gives more privacy than Google.[2]

To have a feeling about the structure of the "internet", one can browse an outdated, but still more or less relevant map of the internet. A list of the biggest websites (globally and by country) can be found on Alexa. (Or a more recent poster can be seen here)

To see how some sites evolved in time, one can use Wayback Machine to explore (and/or make) archived versions of sites.

On the internet, sites can be different not only in time, but by accessing them from different location. (A site (or a server) knows about you this amount of information.) To access sites, with possible Geo-blocking one can use VPN.

On the internet there are many-many things, and sometimes you are searching for alternative sites. In these cases AlternativeTo or SimilarSites can be helpful.

Gain information about a website, use who is and possibly check it on Alexa or on SimilarWeb.

3.1 Current information

It is crucial to realize, that in general the aim of news organizations is to grab attention, and not to give a balanced world view to the readers. It does not mean, that news organizations always want to distort our view, but it means, that if someone wants to have a realistic view, then reading the headlines is not enough. Additional sources and statistics are crucial for a better understanding of the world around us.

- Our World in Data
- Gapminder

To understand the case, one can watch Stephen Pinker's presentation, or these articles on Our World in Data and BBC Future (based on the data from Gapminder).

[2] Google's Russian and Chinese alternatives are Yandex and Baidu respectively.

On the other hand, positive change will not happen, if individuals don't take actions, and past statistics will not inform us about current trends, movements, challenges. For that we need reliable news sources (or a way to extract information from imperfect and biased sources).

To check a news source's Media bias one can use these sites

- AllSides
- The Media Bias Chart
- Media Bias/Fact Check

To fact check some typically sensational news one can use these sites

- Snopes in English
- Urban legends in Hungarian

An incomplete list of reliable International and/or English news sites:

- General news with little bias
  - AP
  - Reuters
  - NPR
  - BBC News
  - Deutsche Welle
- Thematic news
  - The Economist (Economics)
  - Financial Times (Economics, finance)
  - Wired (IT, Technology)
  - Politico (Politics)
  - EuroNews (Europe, EU)
  - Politico Europe (European Politics)
  - Foreign Affairs and Foreign Policy (Global Politics and Foreign Affairs from a USA perspective)
- Left leaning, but still reliable sources
  - The Guardian
  - The Atlantic
  - New York Times
- Right leaning (economically), but still reliable source [3]

[3] a more complete USA based list of right wing / conservative news sites is available here

  - Reason

An incomplete list of reliable and/or relevant Hungarian news sites:

- Eduline (Education, news about schools and Universities)
- Qubit (Science and Technology)
- Telex (General news, slightly liberal, critical to government)
- Válasz (General, slightly conservative, critical to government)
- Magyar Hang (General, independent, critical to government)
- Mérce (General, left leaning, critical to government)
- Magyar Nemzet (General, pro government)
- Mandiner (General, pro government)
- 444 (General, liberal, critical to government)
- Azonnali (General, more or less balanced, critical to government)
- Atlatszó (Investigatory "watch dog" journalism, critical to government)
- Regional online media
  - szabadhirek.hu (Collection of Hungarian independent regional news portals)
  - Mediaworks owned media (Collection of Hungarian regional media outlets, with pro government sentiment owned by a close friend of the prime minister)
- Hungarian minorities media in neighboring countries
  - Romania
    * Transindex (General, Hungarian minority in Romania (with pro Hungarian government sentiment))
    * Transtelex (General, Hungarian minority in Romania)
  - Slovakia
    * Körkép, ma7 (General, Hungarian minority in Slovakia (with pro Hungarian government sentiment))
    * Ujszo (General, Hungarian minority in Slovakia)
    * Napunk (Hungarian language edition of the Slovakian media portal Denník N)
    * Pozsonyi podcast (Podcasts about Hungarian politics, culture, education in Slovakia)
  - Serbia

    - MagyarSzo (General, Hungarian minority in Serbia (with pro Hungarian government sentiment))
    - SzabadMagyarSzo (General, Hungarian minority in Serbia)

There is a list of centralized, pro government media sources, called KESMA, which has a conservative/populist bias. Together with the state media MTV, these news sources represent the governments narrative.

Index was a slightly liberal portal, critical to government, however in 2020 after changes in top management, most of the journalists resigned, and started Telex.hu. After this turn Index become slightly pro government, but kept some elements of its original style.

For a more comprehensive list see the collection of Hungarian newspapers on Wikipedia.

In politically sensitive questions I highly suggest to read and watch multiple sources, mainly in and about Hungary.

A list of unreliable, "news" sites, which produce content purely to maximize their click numbers is published by Urban Legends.

3.2 Blogs

Today everyone with internet connection can be a content creator. Blogging is neither professional journalism, nor scientific publishing, but sometimes professionals and enthusiasts can write about interesting ideas in a accessible way.

- Medium

Examples of informative technical blogs:

- Wait But Why
- inFERENCe
- mathbabe
- Galef siblings

3.3 Forums

Online forums can be good sources of information, if one can critically investigate the opinions and suggestions which can be read there. In general Stack Exchange is considered as a useful international online forum. Reddit is one of the biggest general forum, with many "subreddits". The quality of the content is fluctuating, but there are some intersting concepts, like the Ask Me Anything (AMA) sections, where professionals, interesting and/or popular people answer to questions from the users. A general forum in the internet is Quora this is very general, and further investigation is needed to check the information from it.

In Hungarian one of the oldest IT forums is Prohardver. A much newer general online forum is Gyakori kerdesek, which unfortunately has a low reliability. There is also a Hungarian subreddit on Reddit.

3.4 Communication tools

During the pandemic (COVID-19) there was a huge demand for online communication tools, which were used in education, work, and in keeping touch with friends and relatives.

- For video and team calls
  - Zoom
  - Facebook messenger
  - Skype
  - Google Hangouts
  - Google Meet
  - Jitsi Meet
  - Microsoft Teams
- for chat
  - Facebook messenger
  - Telegram
  - Signal
  - Slack
  - Discord

3.5 Social media

Social media – such as all technology – can have positive and negative impact on individuals and societies alike.[4] It has the potential to connect people, be an aid for forming groups, organizing events, starting projects, but it can also isolate people from "real life" experiences, foster unrealistic expectations, polarize societies, reinforce addictive behaviour, etc.

My suggestion for users or potential users of these platforms, is to:

- recognize addictive behaviour (and possibly set boundaries),
- understand the business model of the given platform,
- be aware of algorithms choosing "relevant" content,

[4] For a summary about the inconclusiveness of current research see this article, or this much more detailed google doc.

- and have a thought about privacy issues.

Maybe I should reiterate the main message: these days there are a few global companies which are capitalizing their users social connections, and – because of general ignorance toward privacy – they have access to a nearly unimaginable amount of data both about individuals and their social circles. Because of this corporate model the platforms are engineered to be addictive, usually by finetuned recommendation systems, and other algorithms promoting engagement. (But the popular criticism of these platforms might be partially attributed to Juvenoia as well. Meaning, that what older generations thinks are harmful, are maybe just different compered to their environment.)

A list of a few major platforms:

- Twitter
- Facebook
- YouTube
- photos, short videos:
  - Instagram
  - TikTok
- job, work related:
  - LinkedIn
- (regional) alternatives
  - V Kontakte Russia
  - We Chat China

3.6 Misc

- Less Wrong
- Center for Applied Rationality
- The Skeptic Encyclopedia of Pseudoscience

4 Subjects

4.1 Physics

Physics is one of the "hardest" branch in the Natural sciences, and is the purest embodiment of the Scientific method. It briefly means, that it builds testable mathematical models about the world, mainly in a reductionist way. (Reductionism brought us to the current impressive level of understanding, and

predictive power, however, it is less useful in attacking complex systems.) It has 2-3 branches: Theoretical physics, which is mostly about model making, Experimental physics, which is about collecting data and designing experiments, and Computational physics which is sometimes viewed as a separate branch, and tries to compute the consequences of theoretical models (typically with many constituents).

- The Feynman Lectures on Physics One of the best theoretical physics introduction. It uses a little bit of calculus, but because of its didactic style, interested high school students can read it as well. Feynman on magnets.
- University Physics with Modern Physics is a nicely illustrated physics book, it does not use too much higher mathematics. It is also a nice book for interested high school students. (A similar resource is Physics for Scientists and Engineers with Modern Physics)
- Walter Lewin. Physics deals with phenomena in Nature. Walter Lewin is a physicist and an entertainer. His demonstrations are simply fun to watch.
- Härtlein Károly is a prominent figure of Hungarian physics demonstrations. Explore his demonstrations and physics shows online. His wiki page. (in Hungarian)
- Öveges József, an iconic Hungarian physics popularizer and teacher. See his performance and/or his book (on scribd)
- Négyjegyű is a Hungarian formula sheet and source of tabulated experimental data.
- Szalay Fizika is a comprehensive handbook about general Physics (from slightly engineering perspective), using high school mathematics. It is in Hungarian. A scanned version of its electromagnetism section can be found here (see on scribd).
- A cultural history of physics is an extended book, which explores the historical development of Physics, and puts the subject into a wider perspective.
- Physics competitions:
  - KöMaL is a perfect source of challenging problems for high school students from Mathematics, Physics and Computer Science.
  - IPhO stands for the International Physics Olympiad. Past problems can be found here, here and here. The syllabus is available here. (past problems in Hungarian)
  - Hungarian IPhO preparation Seminars, past problems in Hungarian.

  - APhO stands for Asian Physics Olympiad, and has an equal difficulty level to IPhO. Past problems (from 2019) are available here.
  - Physics Cup "more difficult than the problems of EuPhO, IPhO, and APhO."
  - List of other international Olympiads
  - IOAA International Olympiad on Astronomy and Astrophysics
  - Fykos
  - IYPT International Young Physicist's Tournament. Team-oriented open ended scientific competition between secondary school students. Hungarian section HYPT and a related competition is ICYS.
  - BL4S Beamline for Schools, is an international experiment constructing competition for high school students
  - Hatvani István Physics Competition
  - List of Hungarian Physics competitions
  - Rudolf Ortvay International Competition in Physics University level international physics competition.
  - International Theoretical Physics Olympiad for Undergraduate Students.
  - NyiFFF Hungarian outdoor University level (mainly experimental) Physics competition.
  - IEPhO International Experimental Physics Olympiad (in Russian)
  - IPT International Physicists' Tournament, it is similar to IYPT but for undergraduate University students.

- Error Analysis is a useful basic book to interpret data, collected during experiments. (Student Laboratory Handbook gives a similar knowledge.)

- Softwares for data analysis and visualization

  - QtiPlot is cross platform (Linux, Mac OS, Windows) "free" (but proprietary) plotting and data analysis software. On Source Forge, and on FSF.
  - Origin is the most popular commercial plotting and data analysis software (works only on Windows)
  - Wolfram Mathematica much more general than data visualization and analysis. All the nonlinear fits and the appropriate statistical analysis can be made in this framework as well. (Commercial, cross platform.)

- A few steps during solving problems

- 200 Puzzling Physics Problems creative (non conventional) physics problems. (Available online, but support the authors if the book is useful for you)

- 200 More Puzzling Physics Problems more creative physics problems. (Available online, but support the authors if the book is useful for you)
- 333+ furfangos feladat fizikából creative physics problems in Hungarian.
- Collection of Solved Problems in Physics for high school students.
- Kísérleti fizika 1 University level, Hungarian introduction to Physics lecture notes (Mechanics)
- Kísérleti fizika 2 University level, Hungarian introduction to Physics lecture notes (Electromagnetism and Special relativity)
- Kísérleti fizika 3 University level, Hungarian introduction to Physics lecture notes (Thermodynamics and Quantum mechanics)
- Kertész János - Zaránd Gergely - Deák András Statisztikus fizika
- Landau-Lifshitz "Russian style" theoretical Physics book for University level
- Mathematical Methods of Classical Mechanics classic graduate textbook by mathematician V. I. Arnold. Mathematically accurate and deductive in the same time. (Online available here)
- David Tong: Lectures on Theoretical Physics University level lecture notes in Theoretical Physics topics
- Astronomy Today a nice textbook about Astronomy (Another nice online resource can be found on the homepage of NASA)
- Physics FAQ
- The Review of Particle Physics Most recent tabulated data about Particle physics and related parts of Cosmology.
- Falstad Math/Physics simulations Interactive simulations mainly about Electromagnetism and Wave mechanics.
- Spacetime Physics by Taylor and Wheeler is a really nice introductory book to relativity (available here)
- Relativistic visualizations
- A Slower Speed of Light a first-person game from MIT Game Lab, in a slower speed of light environment.
- The Biggest Ideas in the Universe! by Sean Carroll
- AtomCsill "Az atomoktól a csillagokig". Presentations for high school students in Hungarian.

- Nobel Prize experiments for high school students on the BUTE (BME). (In Hungarian)
- S^3 and S^3++ Science summer schools in Croatia for high school students.
- Hungarian-English dictionary for scientific terms. (In Hungarian.)
- Other reading list and books
  - Simon Clark's list
  - Baez list for fundamental/mathematical physics
  - Forces of Nature by Brian Cox
  - Brief Answers to the Big Questions by Stephen Hawkin
- fun
  - IBM Q-experience Online quantum computer
  - What If? by Randall Munroe (the crator of xkcd)
- possible projects:
  - TESS Transiting Exoplanet Survey Satellite (official page)

4.2 Mathematics

Mathematics has many-many sides, one would say it is a language, others would say it is a playful but rational way of thinking and problem solving, still others would emphasize its extraordinary usefulness in science and technology.

- Obádovics book is a detailed and didactic book which is a textbook, perfect for high school students. However, it does not contain too many proofs. Its main aim is to give a solid basis for the usage of high school mathematics mainly in engineering problems. (Which is only one side of mathematics.) It is in Hungarian, online available here.
- How to Solve It? by George Pólya is about how to approach a problem systematically, but creatively. "Teaching is an Art". See a summary here (or on wikipedia), and a Pólya's performance here.
- Proofs from THE BOOK an idea of Paul Erdős, where all the beautiful proofs are listed ("The Book" is only accessible for "God", we can only construct imperfect versions.) A lecture of Erdős in Hungarian.
- Handbooks
  - Bronshtein and Semendyayev An extensive "handbook" of mathematical formulas
  - Handbook of Mathematical Functions by Abramowitz. An extensive handbook of (special) functions and formulas.

  - Online Handbook of functions and formulas.

- More about proofs
  - Proofs Without Words visual "proofs" give an intuitive understanding of various theorems. Follow up books here and here.
  - How to Prove It "The transition from solving problems to proving theorems"
  - Elements by Euclid

- Competitions/Fun
  - KöMaL is a perfect source of challenging problems for high school students from Mathematics, Physics and Computer Science.
  - A gondolkodás öröme Exploratory experiencing of Mathematics (in Hungarian)
  - Erdős Mathematics School
  - Calendar for Hungarian Competitions (and another calendar.)
  - List of mathematics competitions world wide
  - IMO International Mathematical Olympiad
  - European Girls' Mathematical Olympiad
  - MEMO Middle European Mathematical Olympiad. (Hungarian homepage)
  - Arany Dániel Competition (Hungarian)
  - Kürschák József Competition (Hungarian)
  - Schweitzer Miklós Competition (Hungarian)
  - Bolyai competition Group competition Hungarian, and International.
  - MaTeGyE further math competitions in Hungary
  - Náboj
  - Putnam Competition for USA and Canadian undergraduate students.
  - Квант magazine in Russian. (Archived Quantum issues in English)
  - Wycombe Abbey Summer Mathematics Competition
  - University level:
    * International Mathematics Competition for University Students

- Concrete mathematics: a foundation for computer science

- Linear Algebra
  - Obádovics Vektoralgebra; mátrix determinánsok; többváltozós függvények. A basic, application based introduction in Hungarian

  - Linear Algebra by 3Blue1Brown
  - Linear Algebra A nicely illustrated "second course" in Hungarian
  - Linear Algebra Done Right "Perfect second textbook" for linear algebra

- Calculus
  - Obádovics: Felsőbb matematika is high quality didactic textbook, focusing on the usage and application of Calculus. (In Hungarian.) Online available.
  - Essence of Calculus on YouTube
  - Two standard calculus books with problems from Stewart and Spivak
  - Principles of Mathematical Analysis from Walter Rudin is a classic Mathematical introductory to Calculus also know as Mathematical Analysis. It focuses on the coherent mathematical foundation of calculus, and on applications.
  - Analysis I, Analysis II by Terence Tao
  - Counterexamples
    * Counterexamples in Probability and Real Analysis
    * Counterexamples in Analysis
    * Counterexamples in Topology
    * Counterexamples in Probability

- Mathematical softwares
  - Wolfram Mathematica mainly for symbolic computations (commercial)
  - Sage an Open source but less powerful alternative for simbolic calculations
  - GeoGebra is a nice tool for geometry problems

    Further softwares
    * Matlab is useful mainly for numerical analysis
    * GNU Octave is a useful open source alternative for Matlab
    * gnuplot a very basic open source plotting and fitting tool.
    * R used typically for statistics
    * Jupiter is a nice exploring and presenting tool together with (for instance) Python.
    * much more can be found on Wikipedia, starting for instance from here.

- Comprehensive textbooks

  - What is Mathematics "Mathematics as an expression of the human mind reflects the active will, the contemplative reason, and the desire for aesthetic perfection."
  - Mathematics: Its Content, Methods and Meaning close to real world but precise and high quality comprehensive book in the "Russian spirit" familiar from the books of Arnold and Kolmogorov.
  - The Princeton Companion to Mathematics "General Map of Mathematical World"

- History of Mathematics
  - History of Mathematics
  - Nincs királyi út! by Sain Márton. History of Mathematics in Hungarian
  - A Very Brief History of Mathematics podcast by Stephen Wolfram
  - Math Geneology Project
  - History of Mathematics Project

- Mateking partially commercial, but useful source of study materials (Hungarian).
- Interactive Mathematics high school/undergraduate level mathematics topics with real life and interactive examples
- Mathematics Enhancement Programme Study materials from The Centre for Innovation in Mathematics Teaching CIMT.
- Art of Problem Solving commercial, but nice.
- Solving Mathematical Problems by Terence Tao
- Terence Tao
- Millenium problems Unsolved problems in Mathematics
- Open Problems With Monetary Rewards
- Hungarian final examination (Érettségi feladatok) in Hungarian
- Other books and sources
  - Euclidean Geometry in Mathematical Olympiads by Evan Chen
  - An Infinitely Large Napkin
  - Illustrated Elements of Euclid by Oliver Byrne
- Other reading lists
  - Cambridge Mathematical reading list

  - Oxford reading list under "Recommended Mathematics Reading"
  - MIT reading list
  - Baez list for fundamental/mathematical physics
  - Toby's list

- fun
  - 99 Variations on a Proof by Philip Ording

4.3 Computer Science

Computer Science (CS) is a huge umbrella term, which covers Algorithms, Programming, Theoretical information theory, Networking, Cybersecurity, Artificial Intelligence (AI), Robotics and vast number of other areas. Broadly speaking it can be divided into Theoretical Computer Science, and Applied Computer Science, which is basically programming.

This branch is more industry and application driven then Physics and Mathematics in general, because of its huge and recent impact on society (see Digital revolution and the fourth industrial revolution). However, many other academic and even ethical questions arise which are deeply connected to Computer Science and its applications.

Computer science is a rapidly advancing field and the cutting edge is moving very fast. Because of that computer science is not something what can be learned completely from an older, more experienced teacher, but is a constantly ongoing discourse, between accumulated knowledge and novel technologies.

Because of its reflexivity on society, AI ethics is a relevant part of CS.

- Computational Thinking
- Map of Computer Science shows the current domain of CS (image format)
- Cambridge A-level gives a summary about various topics, covering basic skills and knowledge
  - CS A-level Course book. Online available here and here.
- Books about Problem solving/Computational thinking/CS in general:
  - How to Solve it by Computer
  - The New Turing Omnibus is an exhaustive review of topics in CS (suggested for freshmans on CS at Cambridge)
  - How to think like a mathematician helps to get familiar with analytic thinking required for CS (suggested for freshmans on CS at Cambridge)
- Codecademy is a useful place to learn programming

- tutorialspoint provides quick tutorials for many languages, together with an online compiler for the code.
- Programming languages. There is a plethora of programming languages, however here I will list a few from the "more relevant" ones. From an even shorter list I would mention a few (another measure of popularity can be seen here.)
  - Overview of languages from job market point of view
  - C basic Procedural language
  - C++ basic Object-Oriented language
  - Python a very popular, easy to learn language
  - other languages
    * HTML Hypertext Markup Language, the "language of websites"
    * SQL for standard database management
    * LaTeX markup language of most academic papers
    * Java is another very popular programming language, which due to running on a Virtual Machine, is very suitable for developing cross platform applications (such as different operating systems, e.g., notably Android).
    * bash scripting language
    * Haskell a popular functional programming language
- Hello World. Learning a new programming language starts with the creation of a tiny working code, usually printing or outputing "Hello World". The first working code is crucial, because from it one can explore the functionalities of a language (or a package) by little, incremental steps trough working codes. (Without a complete list of languages and editors, or Integrated Development Environments (IDE-s).)
  - HW C, Linux (Ubuntu).
  - HW 01, 02, 03, 04 C, Windows. The tutorial in one HW list.
  - HW Python, Linux (Ubuntu)
  - HW Python cross platform
  - HW C++, Linux (Ubuntu)
  - HW C++, Windows
  - Hello World code on many-many other programming languages. (Another collection here)
- Standard books on programming
  - C Primer Plus A huge, but popular introductory book into C
  - The C programming language by Kernighan and Ritchie. A classic, from the creators of the language.

  - Programozás C nyelven by Pere László, a book in Hungarian (online available here)
  - C++ Primer A huge, but popular introductory book into C++
  - C++ by Bjarne Stroustrup. A classic, from the creators of the language.
  - An Introduction to Python an introduction from the creator, Guido van Rossum.
  - Dive Into Python 3 introduction to Python, for those, who already know some programming
  - Clean Code for an easy (not impossible) to read coding style
  - Best Practices for Scientific Computing

- Graphics
  - OpenGL 3D/2D graphics
  - SDL is a popular library
  - Unity a popular cross-platform Game engine
  - Allegro is simple to use library for 2D graphics

- Integrated Development Environment (IDE). In practice it is good to have an environment, which is essentially a text editor and a compiler, in which one can write, run, debug, and make a version control of its programs. Here are some good to know IDE-s
  - Code Lite C/C++ IDE
  - Spyder Python IDE
  - PyCharm Python IDE
  - other notable IDE-s
    * Sublmie text
    * Code::Blocks
    * Visual Studio
    * Eclipse

- Online references
  - C++ reference
  - Rosetta Code example programs in a huge variety of languages
  - html
  - w3schools for web development in general (HTML, PHP, SQL, CSS, JavaScript, Python, etc.)
  - bash
    * Basic introduction to terminal, and other useful tricks.

        * How To
        * Beginner Guide
        * Advanced Guide
        * Cheatsheets
    - ELTE Haskell interactive university course (in Hungarian).

- Libraries
    - GSL GNU Scientific Library (for C, C++) Wiki
    - Boost a set of libraries for the C++
    - NumPy is the fundamental package for scientific computing with Python (a tutorial for those, who are already familiar with Matlab)
    - SciPy Scientific computing library for Python
    - Matplotlib plotting and visualization library for Python
    - Anaconda a whole (mostly Python) environment for Data Science
- Operational Systems (OS) (Popularity of OS-s can be found here and here)
    - Virtual Box is a very useful emulator to try out different OS-s in a virtualized environment
    - Linux which ha many distributions.
        * Ubuntu is useful for general use. (A guide for installation)
        * Kali is a "hacking OS" with many built in Penetration Testing tools
    - MacOS is a Unix based OS of apple computers
    - Windows originally an MS-DOS based operating system
    - Android is a Linux based mobile OS
    - iOS is a Unix like OS for mobiles
- useful shell programs
    - ssh (see this how to for more detail)
    - wget
    - rsync
    - scp
    - htop
    - mc Midnight Commander
- Word processors

  - Overleaf online LaTeX document editor (this document was written on this platform). See their learning page. LaTeXis a standard typesetting language to write scientific documents in many fields, including mathematics, computer science, engineering, physics, chemistry, economics, etc.
  - LyX a LaTeXeditor where the edited content is much closer to the compiled document then in most traditional script base editors. It has a "what you see is what you mean" approach. (Easy and fast to use (with useful keyboard shortcuts) for taking notes or writing short documents, but might have compatibility issues in a collaboration.)
  - LaTeXresources in general
    * TeXMaker a popular offline LaTeX editor
    * LaTeX Wikibook
    * The Not So Short Introduction
    * LaTeX Beginner's Guide
    * LaTeX Math Symbols cheat sheet
    * LaTeX Mathematical Symbols
    * Reference Sheet for a Thesis
    * LaTeX-Tutorial.com
    * Fun symbol detecting tool
  - Google Docs online word processor, presentation editor, etc. from Google.
  - Microsoft Office a word processor with the most users world wide. (MS Office also have an online version)
  - Libre Office free and open-source office software suite (a successor to OpenOffice). Fully capable alternative of MS Office, the main issues are compatibility related.
  - Pages a word processor developed by Apple
  - Prezi
  - Sozi
- other useful applications
  - Wireshark
  - qBittorent
  - MEGA
- git and GitHub: essential for version control and collaborative development
  - Git & GitHub for Windows
  - git, GitHub for Linux (Ubuntu)

  - Pro Git book
  - GitLab an open source alternative to GitHub

- Books and resources on Theoretical Computer Science
  - Algorithms (another book)
  - Art of Computer Programming
  - Knuth
  - Computability and Logic
  - Information theory
  - AI
    * Andrew Ng and his courses on Coursera
    * MLU-ExplAIn an education initiative from Amazon's Machine Learning University
    * MacKay's book
    * Bishop
    * Deep Learning
    * Reinforcement Learning
    * Bandit book
    * Introduction Reinforcement Learning lectures by David Silver in DeepMind and UCL
    * Virtual Machine Learning Summer School 2020

- Other reading lists
  - MIRI reading list
  - AI Stackexchange
  - CS Stackexchange
  - Oxford CS reading list
  - Carnegie Mellon list of books

- Competitions/heckatons
  - KöMaL is a perfect source of challenging problems for high school students from Mathematics, Physics and Computer Science.
  - IOI International Olympiad in Informatics
  - Central European Olympiad of Informatics
  - Google's coding competitions
  - Codeforces
  - AWS DeepRacer
  - Hungarian competitions

  - List of competitions
  - University level
    * ICPC International Collegiate Programming Contest. (A nice preparation book is Competitive Programming)
    * Challenge 24
    * Kaggle Data Science challenges
  - Robotics
    * Robocup
    * Robotverseny
    * micro:bot

- fun
  - Codingame
  - Lightbot
- Quantum computing
  - Qiskit IBM's Python-based library
- Robotics
  - Arduino
  - Maker Space in Hungary
- 3D design and CAD
  - Auto CAD, for other CAD softwares see this list
- Ethical hacking
  - HackerOne
  - Defcon
- possible projects
  - Techtábor (in Hungary)
  - Skawa startup projects in Hungary

4.4 Chemistry

Disclaimer: I'm not a chemist, and didn't do any serious chemistry during my University studies. My view on chemistry is highly subjective, and probably naive. A contribution of a more experienced chemist would be valuable.

I think chemistry as a field is worthless without experiments. If I needed to introduce chemistry to a high school student, I would say, that it is primarily magic and craft, and its view from a analytical and critical lens is secondary (however that makes chemistry a science).

- Demonstrations by Andrew Szydlo and Chris Bishop.
- Fun and interesting videos by NileRed
- Map of Chemistry
- Experiments
  - Safety
  - Experiments at home
- Laboratory experiments
  - Safety (less detailed version)
  - AP Chemistry
- Cambridge International AS and A Level Chemistry
  - Course book online available here
- Náray-Szabó Chemistry book in Hungarian (online available here)
- Atkins books are generally suggested for University chemistry courses
- Resources for Learning Chemistry
- Professor Dave Explains YT channel
- American Chemical Society's YouTube channel, to find out what chemists do.
- Magyar Kémikusok Egyesülete
- Royal Society of Chemistry (UK)
- competitions
  - Kökél "Kömal" for chemistry
  - Hungarian chemistry competitions
  - IChO International Chemistry Olympiad
  - IChTo International Chemistry Tournament. Team-oriented open ended scientific competition between secondary school students.
  - International Mendeleev Chemistry Olympiad (in Russian), past problems from 2015 in English
  - Oláh György Országos Középiskolai Kémiaverseny
  - Curie Chemistry Competition
- Textbooks

  - Organic Chemistry by Jonathan Clayden, Nick Greeves, Stuart Warren, Peter Wothers
  - Principles of Biochemistry by Albert L. Lehninger, David L. Nelson, Michael M. Cox
  - Organic Chemistry: Structure and Function by K. Peter C. Vollhardt, Neil E. Schore
  - DNA Nanoscience: From Prebiotic Origins to Emerging Nanotechnology by Kenneth Douglas
- Handbooks/Data banks
  - CRC Handbook of Chemistry and Physics
  - Dortmund Data Bank Thermodynamic data bank (mainly Commercial)
- fun
  - info graphics
  - Chemistry World magazine
  - Periodic Videos Clips about the Elements
  - NileRed YT channel
  - FoldIt gamification of protein folding problems
- Other reading lists
  - Oxford Chemistry
  - Oxford Biochemistry
  - Cambridge
- Blog
  - In The Pipeline Derek Lowe's commentary on drug discovery and the pharma industry. (Chemistry, medicinal chemistry, drug discovery, drug industry, microbiology, etc.)
- Twitter hashtags
  - #chemtwitter #orgchem #fluorescencefriday
- Internships, projects
  - Material science: Bay Zoltán Nonprofit Ltd. for Applied Research

4.5 Biology

Disclaimer: I'm not a physician or a biologist, and I didn't do any biology class during my University studies. My view on biology is highly subjective, and probably extremely naive. A contribution of a more experienced biologist/physician would be valuable.

Biology is of course a huge umbrella term. In my personal view Biology as a field investigates replicators, which can evolve and interact. More specifically Biology is about chemical life, in which DNA/RNA molecules evolve by mutations and complicated interactions. (It is interesting, that this life form is the dominant and most complex one that we know.)

Closely related fields are Physiology and Medicine, which are more anthropomorphic (in my view), and are interested in the functioning and "health" of a single individual.

- Map of Biology sketches the main topics in Biology (poster version)
- Campbell Biology is the main textbook for biology (mainly for undergraduate students). (Online available here)
- The selfish gene by Richard Dawkins is a popular introductory to the genetic (or replicator centered) view of life. (Online available here)
- Cambridge A-level
  - Biology A-level Course book online available here
- "Standard" online courses
  - Biology on Khan academy
  - Crash Course Biology
  - Crash Course Ecology
  - Crash Course Anatomy & Physiology
  - Biology MIT OCW
- Introduction to Biology on study.com (commercial)
- iBiology a free online resource
- Tree of life explorer
- History
  - A History of the Life Sciences
  - The great ideas of biology
- Competitions
  - IBO International Biology Olympiad

  - Hungarian Biology Competitions for high school students
  - iGEM Competition world wide synthetic biology event. (Intense genetics focused team competition.)
  - European DNA Day Video/Essay Contest organized by European Society of Human Genetics
  - DNA Day Essay Contest organized by American Society of Human Genetics
  - Neuroethics Essay Contest

- Other reading lists
  - Introductory Biology texts from Biology Stack Exchange
  - List of lists from Biology Stack Exchange
  - Books for beginners from Biology Stack Exchange
  - Cambridge Natural Sciences reading list
  - Oxford Biomedical Science
  - Oxford Medical school
  - Medical school introductory advice from Medical Sciences Stack Exchange
  - The best books for medical school Advice & Resources for the First and Second Years of Medical School

- Human Biology
  - Atlas of Human Anatomy
  - Zygote Body a 3D anatomy atlas
  - Visible Body a 3D anatomy atlas (Commercial)
  - Human Behavioral Biology Lecture series by Robert Sapolsky, on Stanford.
  - The Human Body BBC educational series
  - Healthcare statistics
    * Global Burden of Disease (GBD)
    * Causes of Death on Our World in Data
    * WHO data and statistics

- Mathematical Biology
  - Society for Mathematical Biology
  - Proving Darwin: Making Biology Mathematical by Gregory Chaitin (The framework and the book is not so great (admitted by Chaitin as well), but the idea might be interesting)

- fun
  - Journey to the Microcosmos YT channel
  - Microscopic Life YT channel of the American Museum of Natural History
  - Animalogic YT channel about animals
  - Spore evolutionary video Game
  - Mini PCR possible home genetic lab
  - Cambridge University Museum of Zoology
- Extended evolutionary synthesis is a newer way to look biological evolution wiki.
- Projects, internships
  - Sainsbury Laboratory in Cambridge

5 Subjects II

To save further lines of disclaimers I grouped the subjects I know less about together.

A **General Disclaimer** holds: **I'm not a Philosopher / Psychologist / Historian / Economist / Sociologist / Lawyer, etc., and I didn't do any serious formal classes during my University studies regarding these fields. My view on these subjects is highly subjective, and probably extremely naive. A contribution of more experienced scholars/practitioners is much needed.**

Against my limited knowledge in the topics, I tried to collect together useful links and sources I learned from interested students, and fill the gaps with resources I found reliable or useful for my self. The patchwork of resources, competitions, books, all with varying depth and difficulty can not provide a coherent track for serious self study. However I hope it can help in initial explorations and can enrich a standard curriculum.

5.1 Philosophy

General Disclaimer: I have limited knowledge in this field.

- Stanford Encyclopedia of Philosophy
- International Philosophy Olympiad
- Dialexicon philosophy journal for high school students
- Trinity College Cambridge Essay Competition
- Baltic Sea Philosophy Essay Event

- "human rights competition" of Amnesty International
- Cambridge, Oxford & London Summer School Essay Competition
- book and sources
  - Lecture on Ethics by Wittgenstein
  - After Virtue by Alasdair MacIntyre
  - Isaiah Berlin, "TWO CONCEPTS OF LIBERTY"

5.2 Psychology

General Disclaimer: I have limited knowledge in this field.

- The Brain by Gary L. Wenk
- Introduction to Psychology by Paul Bloom (Coursera course)
  - Psychology by Peter O. Gray is the seggested textbook for the course
- Introduction to Social Psychology on edX
- SimplyPsychology helpful study guides
- American Psychological Association (APA) great pool of resources
- books:
  - Atkinson & Hilgard's Introduction to Psychology
  - Disorders of Childhood
  - The Man Who Mistook His Wife for a Hat and Other Clinical Tales by Oliver Sacks
- competition
  - Neuroscience Competition for Teens
  - TOPSS Competition for High School Psychology Students Essay competition hosted by the APA
- Internships, projects
  - Central European University Baby Lab
  - Central European University Vision Lab

5.3 Medicine

General Disclaimer: I have limited knowledge in this field.

- Books
  - The Emperor of All Maladies
- competitions
  - Brain Bee Neuroscience Competition for Teens
- The Lancet peer-reviewed general medical journal
- Mayo Clinic
- NHS
- magazines
  - Healthline
- possible projects:
  - e-NABLE makes 3D printed prosthetic upper limb devices
  - Institute of Experimental Medicine in Hungary
  - Bethesda children Hospital

5.4 History/Archeology

General Disclaimer: I have limited knowledge in this field.

- What Is History? by Ignác Romsics in Hungarian (see written version here and here)
- Philosophy of History
- Hungarian History and Literature online high school classes in Hungarian
- Magyarország Története documentary series on Hungarian history in Hungarian (see background here)
- GeaCron online Historical World map from 3000 BC
- books
  - The Oxford History of Ancient Egypt
  - Amarna Sunset and Amarna Sunrise by Aidan Dodson Wonderful Things by Jason Thompson Orientalism by Edward W. Said Middle Egyptian An Introduction to the Language and Culture of Hieroglyphs

  - Historical Dynamics or Cliodynamics by Peter Turchin

- competition
  - Estöri creative history competition
  - Mary Renault Essay Competition on a topic relating to the reception of classical antiquity – including Greek and Roman literature, history, political thought, philosophy, and material remains – in any period to the present
  - UCL Classics Essay Competition

5.5 Geography

General Disclaimer: I have limited knowledge in this field.

- World Factbook CIA's World Factbook
- books
  - The Uninhabitable Earth: Life After Warming by David Wallace-Wells
- "Itthon-Otthon Vagy" Földrajz Verseny
- Projects, internship
  - Interreg-danube

5.6 Economics/Politics/Law

General Disclaimer: I have limited knowledge in this field.

- Capitalism: A Very Short Introduction
- The Economy Great free online textbook
- Sociology by Anthony Giddens
- An Introduction to Political Thought: Key Concepts and Thinkers by Peri Roberts, Peter Sutch
- Democracy and the rule of law in the European Union online course
- Security & Safety Challenges in a Globalized World online course
- Justice This introduction to moral and political philosophy is one of the most popular courses taught at Harvard College (published on YouTube as well)
- Is Eating People Wrong? by Allan C. Hutchinson

- books
  - Thinking, Fast and Slow by Daniel Kahneman (Behavioral economics)
  - Predictably Irrational: The Hidden Forces That Shape Our Decisions by Dan Ariely (Behavioral economics)
- projects/internships
  - 21 Research Centre political think tank in Hungary
  - MFC Equity
  - Revas online business games

5.7 Literature

General Disclaimer: I have limited knowledge in this field.

- Hungarian literature
  - Magyar Elektronikus Könyvtár MEK
  - Szerb Antal: Magyar irodalomtörténet available on MEK
  - Hogyan írjunk verset? by Lackfi János snippet
  - A vers ellenforradalma by Horváth Viktor (on scribd)
  - Szép Magyar Beszéd Hungarian Recitation Contest
- International Literature
  - Szerb Antal: A világirodalom története available on MEK (in Hungarian)
  - Babel Matrix
  - "The Greatest Books of All Time"
  - World Literature Categories on Five Books
  - The Big Read popularity contest for the most loved novels in the UK in 2003 (see Similar contests for more popularity lists)
  - A Poetry Workshop offered by California Institute of the Arts
  - Poetry Out Loud English (USA) Recitation Contest
  - Poetry In Voice English (Canada) poetry ricitation and writing contest
  - Shakespeare's Globe productions

5.8 Language skills

General Disclaimer: I have limited knowledge in this field.

- English
  - IELTS
    - Fastrack IELTS a YouTube channel by Asiya
    - AcademicEnglishHelp another YT channel for Academic IELTS
  - TOEFL
  - British Council
  - Dictionaries, Synonyms
    - Google Translate
    - Thesaurus
    - Merriam Webster
    - DeepL Translator
  - Style and Grammar
    - General post about the non-prescriptive nature of English grammar
    - English Grammar Reference from the British Council
    - The New York Times Manual of Style and Usage
    - AP Stylebook
    - Other Style guides
- German
  - Goethe-Institut
- French
  - DELF DALF
- Spanish
  - DELE
- Slovak
  - e-slovak
  - Cseregyerek exchange program for 8-15 years old Hungarian children living in Slovakia
- Peculiarities
  - Interslavic see official page

6 Complementary materials

6.1 YouTube channels/Podcasts

- YouTube channels
  - The Royal Institution
  - Kurzgesagt
  - Sixty Symbols
  - 3Blue1Brown
  - Domain of Science
  - Numberphile
  - Mathologer
  - Periodic Videos
  - SmarterEveryDay
  - Steve Mould
  - Professor Dave Explains
  - CGP Grey
  - Veritasium
  - Sabine Hossenfelder Science without the gobbledygook
  - Vsauce
  - minutephysics
  - minuteearth
  - Physics Girl
  - Up and Atom
  - Map of Science
  - Computerphile
  - The School of Life
  - Practical Engineering
  - AppliedScience
  - Geography Now
  - Langfocus
  - Crash course for Aliens from Zogg
  - Cogito
  - Let's Talk Religion
  - Overthink Philosophy Podcast
  - Carneades.org Philosophy

  - Great Art Explained
  - OverSimplified
  - TierZoo
  - Jubelee
  - Medlife Crisis
  - Oxford Union
  - IntelligenceSquared Debates
  - The Munk Debates
  - The Nexus Institute
  - Talks at Google
- Other podcasts
  - Hidden Brain
  - The Naked Scientists
  - TED Ed
  - Sean Carroll's Mindscape Podcast
  - Freakonomics
  - Blogging heads (USA politics, news, etc.)
- fun
  - The Scale of the Universe other examples from Wikipedia
- Hungarian
  - Mindentudás Egyeteme further videos here.
  - Atomcsill, Az atomoktól a csillagokig
  - Szertár
  - Vírus Klub
  - Mindenki Akadémiája
- Other lists
  - Top 100 Educational YouTube Channels
  - 60 YouTube channels
  - 100+ YT channels

6.2 Books, reading lists

- Brave New World by Aldous Huxley
- The Black Swan: The Impact of the Highly Improbable by by Nassim Nicholas Taleb
- Factfulness by Hans Rosling
- Sapiens by Yuval Noah Harari
- Life 3.0: Being Human in the Age of Artificial Intelligence by Max Tegmark
- Reading lists
  - Bill Gates collected recommendations from 2012 to 2020
  - The Big Questions Series

6.3 Real life events

6.3.1 Science festivals

- Kutatók északája (in Hungary)
- Pint of Science
- CERN open days

6.3.2 Science museums

- Csodák Palotája
- Museum of Mathematics
- Science Museum London
- Museum of Science Boston
- Oxford University Museum of Natural History with digitalized online collection
- Semmelweis medical museum

6.4 Summer schools

- $S^3/S^3{+}{+}$ in Croatia
- Wolfram High School Summer Camp in Boston
- MaMuT summer camp in Hungary
- Maths Beyond Limits in Poland

- INSEAD Institut Européen d'Administration des Affaires in France
- Immerse Education in England
- NYFA TEEN KIDS CAMPS IN FILM, MEDIA, PERFORMING ARTS organized by the New York Film Academy
- Varázslatos kémia tábor in Hungary

6.4.1 Other competitions

- Oxford Schools debating competition
- National Debate Qualifiers
- World Schools Debating Championship
- Jugend Debattiert
- John Locke Essay Competition
- National Conference of Researching Students (Kutdiák)
- International Natural Sciences Tournament
- IYNT International Young Naturalists' Tournament
- Cinemira International Children's Film Festival
- Ugrás a jövőbe! kreatív pályázat by Moholy-Nagy Művészeti Egyetem (MOME) (in Hungarian)
- Technovation innovation based team competition for girls
- 24h Innovation Marathon by Lauder Javne School
- National Scientific and Innovation Contest for Youth
- Social Impact Award
- International Economics Olympiad
- KEBA A Közép-európai Brókerképző Alapítvány diákoknak szóló pénzügyi vetélkedője
- International Olympiad of Metropolises
- Jugend Forscht
- High School Business Challenge
- First Lego League competition

- Model United Nations find a list of events here and see BIMUN, Munapest and BME MUN for events in Budapest Model European Parliament
- Collection of national competitions in Hungary
- The New York Times Contest including the New York Times Summer Reading Contest
- Competitive Bridge card game
- World Skills

6.5 Teaching/Educational organizations

- Milestone Institute
- go2uni
- Romaversitas
- Kutdiak
- Crimson Global Academy
- Eton College
- Lyceum 239 in Saint Petersburg
- Pre-Collegiate Summer Course at Stanford University
- Yale Young Global Scholars program
- 1000 Girls 1000 Futures
- Smartiz multidisciplinary STEM program for girls
- Alternatív Közgazdasági Gimnázium
- Minds Underground
- Heterodox Academy
- Art of Problem Solving
- Scholarships
  - Study abroad program in USA
    - ASSIST
    - FLEX

6.6 Volunteering/Activism

Reflecting critically on our social circumstance and being an active members of society is a virtue in our modern world. However, one needs knowledge and wisdom to see the relevant problems, and determination to act effectively. While learning your civic roles, be critical, be active, and be brave to revise your own goals and actions time to time.

6.6.1 Real world challenges

Real world challenges does not need to be global. However there are some, which are widely recognised:

- Global Risk Report 2020 by the World Economic Forum (see more reports here)
- The Intergovernmental Panel on Climate Change (IPCC)
- Grand Challenges for Engineering in the 21st Century by the National Academy of Engineering (2008)
- A collection of Grand Challenges on Wikipedia

6.6.2 Organisations

There are many organizations, where one can do volunteering. Some of these are international, some national, and some focusing on a small area. But keep in mind, that you can be active even without joining an organization (for instance by picking up trash in nature).

In some cases even a group can be formed, and for some causes the project can be aided financially for instance by the European Solidarity Corps.

- AFS
- Hungarian Helsinki Committee
- Hungarian Civil Liberties Union
- UNICEF Hungary
- United Nations
- Political Capital Hungarian Political think-tank
- ADOM mozgalom Hungarian high school youth movement
- European Solidarity Corps or in Hungarian
- Order of Malta (their Hungarian Charity Service). A more actual FB page
- 10 miilió FA

- Ökológiai Intézet
- Foncsorozó, NapSukár on Facebook
- Budapest Bike Maffia
- etanoda
- Fridays for Future
- Other collected volunteering opportunities:
  - Milestone Institute's collection

7 University choice

In the 21st century any theoretical material can be learned if someone has a working internet connection. There is a huge variety of online courses, many books and papers are accessible. However, Universities are still useful for:

- Providing practical classes and access to laboratories
- Socializing with your classmates, which can provide a valuable professional network
- Changing and shaping your world view
- Can give opportunities for research (mainly during MSc and PhD)
- Accommodates you to the academic workload

There are three main University ranking sites, which provide a lot of additional useful information.

- Times Higher Education
- QS
- Shanghai Ranking

7.1 Interview tips

There are some universities, when an interview is part of the application process. Before preparing for this round, I think the most important thing is to realize what the interview process is for.

Here the interviewers are usually **not** interested in how flawlessly the candidate can answer all the questions, but in the following 3 main aspects:

- Interest
- Grasp of discipline-appropriate way of thinking

- Teachability

These are mainly meta-learning skills, for which practicing previous interview questions does not help. To figure out the mentioned aspects, the interviewers will ask hard questions, to the point when the candidate needs to figure something out, provide reasons, and take hints / help from the interviewers. If one can calmly form a coherent (but not necessarily perfect) argument and incorporate hints, then not knowing an answer here is not a bug but a feature.

Be prepared to talk about your interests, your motivation to apply to the specific place, and be open for problem solving and reasoning.

For more information see:

- Oxford interview
- Cambridge interview

Past interview questions are available here and here. (There are some other sources, including a book, but I think it is not essential for preparation.)

For online interviews one can get familiar with online shareable drawing tools like Miro.

7.2 Test preparation

For many universities and for various other admissions it is required to take a test. Preparation for these assessments can be time consuming and stressful, but can help to gain a more structured knowledge and to learn how to cope with stress.

In my view tests do not require and enhance skills to solve real world and complex problems. However if one uses the preparation time and the motivation generated by the challenge wisely, the preparation can be used to learn useful things as well.

A few general tips for preparation:

- Know your test
  - University of Oxford admissions tests
  - Engineering Admissions Assessment
  - etc.
- Find past test papers if there are
- Find out the precise actual conditions for your upcoming test (time constraints, scoring details, syllabus, permitted devices (calculator, list of formulas, etc.))
- Familiarize your self with the Syllabus, but don't postpone to solve past tests for the last few weeks

  - PAT Syllabus
  - ENGAA 2021
  - etc.

- Start with the oldest previous tests, and try to solve them simulating the conditions you will face on your own test.
- In case of not enough past problems, one can use similar tests/problems, (for example competition problems) for preparation. Try to find the most similar tests, and still try to solve them (maybe in a modified way) under your own test conditions.
- After you finished maximizing your points on a previous test, you can revisit the hardest questions. In a more relaxed way you can learn something about the background of the problem, or go trough the solution.
- Many times you don't need perfect scores for admission, but aim for 10%−15% more scores that you will probably need, to compensate unknown stress factors during the actual test. Find out past test results, to see realistic requirements.
- Learn and channel your own Stress responses:
  - Surprising link between Stress and Memory
  - Find out your own optimal stress level, and try to achieve it
  - Find way to Relax (if needed)
    * You put a lot of work into the preparation, don't need to worry (if applicable)
    * The test is for finding out if you are suitable for the admission (which can be honest no, by which both parties can continue seeking an optimal fit)
    * If it is hard for you, then it is probably hard for others as well
    * Your existence does not depend on any test
    * Breath deeply, this can physiologically calm you down.
  - Find ways to be Motivated
    * This is can be a good time to show your abilities and step forward
    * The preparation itself can be good mental training
    * Getting familiar with your stress responses will be useful in many other fields of your life
    * If you find the test problems too dry, try to change them in an interesting way after testing
- Some other useful tips
  - Oxford PAT - how to prepare by Simon Clark
  - ENGAA Section 2 Guide and Tips

8 Elements of Pastoral care

In this section I want to share my highly subjective thoughts about psychological difficulties, existential crisis, burn out, well being, finding identity and finding meaning in life. Naturally, I will not provide solid answers to these questions, but I want to summarize the sources and directions which I found useful for myself, for my close friends and relatives, and my former mentees.

In this section, I will use quotes and poetry, not because they are good in transmitting information precisely, but because they can serve as mirrors, and one can explore and understand themselves by them. Because this section is mostly about the reader, yes, about you.

"Believe Those Who Are Seeking the Truth; Doubt Those Who Find It"

— Doesn't Really Matter

8.1 If you need help

8.1.1 Immediate help

There are situations, which are clearly harmful, and intervention is needed. If you face abuse, or you are in danger otherwise, don't hasitate to reach out for consultation and help:

- Hungarian
  - Kék vonal 116 111 (they do pick up the phone, and you can have an anonymous conversation) general crisis line for young people
  - Országos Kríziskezelő és Információs Telefonszolgálat +36 80 20 55 20 (they do pick up the phone and were nice)
  - Magyar Lelki Elsősegély Telefonszolgálatok Szövetsége (LESZ) 116 123
  - NANE +36 80 505 101 For victims of domestic and sexual violence and their supporters
  - TASZ ingyenes jogsegély +36 1 279 22 35 for legal help
  - Hintalovon children's rights organization
- International
  - Child Helpline Networks

8.1.2 Help and Guidance

A summary of the WHO states, that "Globally, it is estimated that 1 in 7 (14%) 10-19 year-olds experience mental health conditions". (See the few most common problems under the link.)

The two main secular branches of medicine dealing with mental health are[5]:

- Psychology
- Psychiatry

The main difference in most countries between Psychology and Psychiatry, is that Psychologists focuses on thoughts, behavioural patterns and social relations, and uses mostly talk therapy, while a Psychiatrists are trained to find biological and biochemical causes of certain mental disorders and they can prescribe psychiatric drugs.

Although psychiatric drugs can help in severe mental disorders, because of the over-medicalization and sometimes serious side effects of these medications, in most cases it is better to first approach a Psychologist.

Even finding a good Psychologist is not simple, as a general advise I recommend to find reviews by previous patients. Fortunately there are some platforms, where collective rating systems can give some information and background:

- Pszichológus Kereső (in Hungary)

However there are many good therapists who are not present on platforms like this. In general it is good to seek for recommendations. Keep in mind, that there should be no obstacle to change to another therapist, if you don't feel comfortable or are stuck with your resent one.

8.1.3 Substance abuse and Addiction

In case of substance abuse probably the first important step is to seek help. There are many places which can give assistance and help, a few I can recommend are:

- Narcotics Anonymous official NA website, Hungarian NA
- Alcoholics Anonymous official AA website, Hungarian AA

8.1.4 Coping strategies

"Adapting the right attitude can convert a negative stress into a positive one."

[5] see a more complete list in the US context here

— Hans Selye

Difficulties and stress is a practically unavoidable part of life. A reasonable goal is not eliminating all stress from life, but to learn how to manage it. This includes:

- Finding the optimal level of stress[6] (which can vary by individual to individual)
- Learn and use effective and sustainable coping strategies such as:
  - Get enough good quality sleep
  - Eat a well-balanced diet
  - Exercise on a regular basis
  - Take brief rest periods during the day to relax
  - Take vacations away from home and work
  - Engage in pleasurable or fun activities every day
  - Practice relaxation exercises such as yoga, prayer, meditation or progressive muscle relaxation
  - Avoid use of caffeine and alcohol
  - some more useful suggestions can be found here

8.2 Changing your self and/or changing the World

"God, grant me the serenity to accept the things I cannot change,
courage to change the things I can,
and wisdom to know the difference."

— Serenity Prayer

In the following sections I assume, that the reader is a teenager or a young adult. (And also I assume, that the reader is not in a miserable situation, where only by apathy or strong faith can they survive the days. I assume that they are not in luxury either from where injustice is merely visible.)

More often than not, people in their young ages observe injustice, unfairness, hypocrisy, etc. in the World, and they are annoyed by it and some of their suffering comes from the difference between how the World "should be" and how it is. This is perfectly normal, and absolutely necessary in a modern society, where change is in many cases seen as constructive and not as a destructive force.

To suggest some material about change and the possible ways to it I suggest Barack Obama's relatively sober advice on the matter.

[6] the mentioned Perceived Stress Scale is archived here

8.3 Well being

Well being is a highly subjective, and not easy to define concept. However, to give some simple and hopefully useful advice, I would list a few relevant concepts popularized by Amit Sood:

- Gratitude
- Compassion
- Acceptance
- Meaning
- Forgiveness

A more detailed list, containing elements, which in my view can be relevant when one faces difficulties, or wants to be more resilient or balanced:

(This is not a check list, and there is no objective grading between the concepts. It can happen, that for you some elements are crucial, while others are irrelevant. These are only aspects, which often can come up as relevant factors.)

- Meaning
  - Meaning is both a deep concept, and a meaningless cliché.
  - Meaning and Happiness
  - Viktor Frankl
  - Ikigai
- Food
  - Food and diet can lead to heated debate even between experts. Because of that my suggestion is not to search for the "best" diet, but to be a bit more conscious, make incremental changes, and figure out which diet would fit best into your own life.
  - The link between mental health and diet is summarized here and on this BBC article
  - a very basic introduction on BBC Bitsize
  - food has a big impact on health and quality of life
  - Diet comparing study
- Physical activity
  - The link between mental health and physical exercise is summarized here.
  - here are some more tips.

- Sleep
  - link between sleep and heath
  - a few tips
  - and a few mindfulness tips
- Compassion
  - "feeling for another"
  - a somewhat relevant quote, which has many variants : "Everyone you meet is fighting a battle you know nothing about. Be kind. Always."
  - compassion and empathy is not only a deeply rooted instinct and possibly foundation of many aspects of morality and ethics, but by cultivating it, one can expand even its identity beyond the spacial and temporal boundaries we usually think our self is confined in.
- Social network
  - Long lasting, meaningful social relationships, with friends and family was found as the most important factor in Harvard Study of Adult Development. Keep in mind, that this is a precious resource, and put energy to develop and maintain your connections, prioritizing quality over quantity.
- Romantic relationship
  - Romantic relationships, seduction, long term relationships, marriage and sexuality is widely debated topic on different levels, and from different aspects. This note can not aim to give a complete discussion of the topic, it tries only to give some starting points and maybe two suggestions: Romantic relationships are changing, because the world around us is changing, this is why creativity and flexibility starts to be more and more important in long term relationships, and why old customs don't always work. There is no one single method for seduction, and real romantic relationships can not be measured in success rates. That is why I would warn you against the so called Pickup artist movement, which targets mainly young heterosexual males, and beside teaching some basic psychology and manipulative techniques totally misses the point by basically objectifying women.
  - There are 36 questions which can help to start meaningful conversations
  - Loving and being in Love
  - The psychology of seduction
  - BBC clip
  - Esther Perel an introductory TED talk and her book Mating in Captivity

  - A dry study
  - Sexuality
    * Human Sexuality Today by Bruce M. King
    * Sexplanations with Dr. Lindsey Doe
- Natural environment
  - BBC article
  - NASA Clean Air Study
- Reasonable comfort
  - in some cases there are scholarship opportunities even for high school students

8.3.1 Meaning

"He who has a why to live for can bear with almost any how."

— Friedrich Nietzsche

Meaning is not something we only find, it is something we create. It is maybe not objectively out there, but most people need to feel that they and/or their life has a meaning.

"For success, like happiness, cannot be pursued; it must ensue, and it only does so as the unintended side-effect of one's personal dedication to a cause greater than oneself or as the by-product of one's surrender to a person other than oneself."

— Viktor Frankl

"Drive overrides fear"

— Elon Musk

8.4 Practices

- Meditation. (But be careful! Matthieu Ricard)

  - a definition: Meditation is a practice in which an individual uses a technique to train attention and awareness, and achieve a mentally clear and emotionally calm and stable state
  - doing a meditation is profoundly easy, and in its basic form it is nothing else then getting familiar with your inner workings by patient and accepting observation. For example you sit down for 10-15 minutes, and just observe your mind and body without any specific aim.
  - single sessions of meditation will probably not make any difference, but a daily cultivation can gradually have an effect on your mind and even on your body and brain. Similarly how teeth brushing works.
  - for more detailed basic instructions see this guide
  - a word of caution: meditation (or getting more conscientious about your body and mind) is not a feelgood exercise only, and if you have unresolved conflicts, they can come up, and if you have rigid believes about reality and your self they can be altered. Go gradually, and ask for help, if you feel too uneasy in a situation.

- Cold exposure
  - also known as the Wim Hof method. See a summary about the matter

- Yoga / Pilates
  - ZoeYoga Beginner - intermediate (Hungarian)
  - Leigha Butler all levels
  - Light on Yoga by B.K.S. Iyengar
  - 15 of the best free Pilates classes
  - Pilates for Men

8.5 Getting Things Done

"Perfect is the enemy of good."

— Voltaire

This is an area, where I personally struggle a lot. In my view there are multiple styles, how different people get things done, and I can not claim that one is better then the other.

A few simple techniques that worked (for me or someone I know personally):

- Make it interesting: there is an art to find the interesting aspects of any task. When I had to study for example a "boring" subject, first I read some

background, and I tried to find something, which is somehow connected to things what I considered interesting. In this way I was able to build up a narrative, in which the given task become interesting and/or important, and use this motivation to go trough the material.

- Write a list: often we need to do multiple tasks on a day/week/month. It can help to allocate a separate time to write down our tasks on a paper (or into a dedicated app like Trello or Google Calendar), acting as our own manager (prioritizing what is important in the long run, against what is rewarding in a short term), and then in a separate regime execute the tasks.

- Avoiding procrastination: the online environment is full of first class procrastination materials. My advice is to cultivate time to time days, weeks when you don't stimulate your brain with certain contents. This can be social media, YouTube, or any other activity which seems to consume uncontrollably amount of time and attention. This is good only to develop a consciousness on the addictive patterns. What is maybe more important, is to invent some working norms and self regulations, for example: limit some activities to certain periods of a day, set time limits, invent "rituals" for instance to start working, or when you go to sleep, etc.

- Brake down the problems: try to brake down all big problems to smaller manageable peaces.

- Start it: as the quotation says "perfect is the enemy of good". If there is something important on your list, or in your mind, but you are postponing because you don't think it will be good enough or you want to do a "perfect" job, than my sincere advice is to start doing instead of postponing. (Most often you are learning while working on the given task, and nearly always you will find flaws on your previous work later (and if you think about it is a good thing, it means that you are progressing).)

- Don't be afraid of failing: "better to have tried and failed than to have never tried at all."

8.6 Meaning of life

"Life is like music for its own sake. We are living in an eternal now, and when we listen to music we are not listening to the past, we are not listening to the future, we are listening to an expanded present."

— Alan Watts Life as Music

"Follow your bliss"

— Joseph Campbell

"We are the cosmos made conscious and life is the means by which the universe understands itself."

— Brian Cox (and many others including Alan Watts)

"I've told thee, man, strive and trust! "

— Imre Madách, The tragedy of man

The philosophy of Kurzgesagt: Optimistic Nihilism
Friedrich Nietzsche The story of the camel, the lion, and the child

8.7 Rules, Paths, Advice

There is no ultimate rule book for life. Every list will only grasp a little fraction of the complexity of existence. To show different flavours and the inconsistent nature of rules I listed some popular / interesting ones together.

8.7.1 The Noble Eightfold Path

1. Right understanding (Samma ditthi)
2. Right thought (Samma sankappa)
3. Right speech (Samma vaca)
4. Right action (Samma kammanta)
5. Right livelihood (Samma ajiva)
6. Right effort (Samma vayama)
7. Right mindfulness (Samma sati)
8. Right concentration (Samma samadhi)

The Buddhist tradition is 2500 years old, and counting. Because of that I believe it needs some context. I suggest Secular Buddhism lecture by Stephen Batchelor. (Right understanding traditionally refers to accepting reinkarnation. However, the process seems to work "only" by accepting the rule of cause and effect, and the non absolute status of our own ego.)

To have a little broader historical view on Buddha and Buddhism I suggest this documentary.

8.7.2 Discipline

1. Stand up straight with your shoulders back
2. Treat yourself like you are someone you are responsible for helping
3. Make friends with people who want the best for you
4. Compare yourself with who you were yesterday, not with who someone else is today
5. Do not let your children do anything that makes you dislike them
6. Set your house in perfect order before you criticize the world
7. Pursue what is meaningful (not what is expedient)
8. Tell the truth — or, at least, don't lie
9. Assume that the person you are listening to might know something you don't
10. Be precise in your speech
11. Do not bother children when they are skate-boarding
12. Pet a cat when you encounter one on the street

Jordan B. Peterson 12 Rules for Life: An Antidote to Chaos

1. Make your bed
2. Find people to paddle with you
3. Measure the size of heart, not flippers
4. Get over being a sugar cookie and keep moving forward
5. Don't be afraid of the circuses
6. Sometimes you have to slide down obstacles head first
7. Don't back down from the sharks
8. You must be your very best in the darkest moments
9. Start singing when you're up to your neck in mud. Hope for everyone
10. Don't ever, ever ring the bell

Admiral William H. McRaven
See his Commencement Address which is a summary of his book.

Jordan Peterson is a polarising character, however he and his message become very popular in a short amount of time, possibly reflecting a hunger for similar father figures. Personally I think discipline and strength are not the single most important skills we need in life, but I mention this school, because some people in some stages of their life might need some push in these areas,

and probably they can resonate to this kind of messages.[7] My meta advice is to be able to maintain discipline, but don't stop there!

8.7.3 Life & work

1. Earn thy neighbor's love
2. Fight for your highest attainable aim
   But never put up resistance in vain
3. It seems to me that mas's ultimate aim in life is to express himself as fully as pssible, according to his own light, and to achieve a sense of security
4. Man must work. I think we have to begin by clearly realizing that work is a biological necessity
5. Whether we call our activity exhausting work or relaxing play depends largely upon our own attitude towards it
6. To remain healthy, man must have some goal, some purpose in life that he can respect and be proud to work for
7. Choose carefully between syntoxic [accommodating] and catoxic [confrontative] behaviour in daily life
8. There is no ready-made success formula which would suit everybody

Hans (János) Selye: Stress without Distress (personal selection[8]). In my view this book and world view is not for everybody, but there are some, who can most easily find their purpose in work and achievements. This book (which I suggest to read in full, to get the whole picture) can serve as guidance and confirmation for those, who resonated to these few lines. However, keep in mind, that the year of publication was 1974, and our scientific understanding slightly changed (for instance about "Adaptation Energy"). Therefore the recommendations of this book are not unavoidable biological truths, but the informed conclusions of the author.

[7] However I would mention, that a similar kind of Christianity inspired self-hep book is not entirely new. Here I would mention M. Scott Peck and his book The Road Less Traveled.

[8] for another summary see this link

8.7.4 More Rules

1. You don't have to dream
2. Don't seek happiness
3. Remember, it's all Luck
4. Exercise
5. Be Hard on Your Opinions
6. Be a teacher
7. Define yourself by what you love
8. Respect People With Less Power Than You
9. Don't Rush

Tim Minchin.
See his speech and/or read a blog-post about the details.

1. We are imperfect,
2. (True) Friendship,
3. Know your Insanity,
4. Accept your idiocy,
5. Good Enough,
6. Beyond Romanticism,
7. Cheerful despair,
8. Transcend yourself.

The Eight Rules of The School of Life. (See in an animated form.)

1. Be adaptive
2. Learn how to deal with failure
3. Be a storyteller
4. Get to know yourself
5. Practice Vipassana meditation
6. Engage with spirituality
7. Study philosophy
8. Read lots of books
9. Develop your social skills
10. Find your mission
11. BONUS - Keep a broad perspective

Collected here from Yuval Noah Harari. Talking to/with young students about The Future of Education

1. Happiness
2. Achievement
3. Significance
4. Legacy

A snippet from Success That Lasts. Further advice can be found in the book: Uncommon Wisdom to Inspire Your Life's Work, which is summarized in the presentation: Building a Life by Howard H. Stevenson. (I want to add, that if one has a dream, and a will to work on it, then it should not be forgotten, even if it is being and actor.)

106 Rules by Richard Templar (or Richard Craze) from his book The Rules of Life. The rules are summarized for example here. (The book can be found here for instance, but consider to buy it if you find useful.)

8.7.5 One "self help" book

I put this here, because based on the the authors summary The Subtle Art of Not Giving a F*ck seems to be actual (in the current (2016) Western world for a middle-upper class reader), and it can embed some core concepts from long existing philosophical traditions into this context. I don't recommend this for depth, but some concepts can be viewed as a fair first approximation for the complex art of living in our times.

8.7.6 Commencement speeches

- J.K. Rowling
- Steve Jobs

8.7.7 Planning and writing about yourself

"No battle was ever won according to plan, but no battle was ever won without one... Plans are useless, but planning is indispensable. "

— Dwight D. Eisenhower

- YearCompass
- Future Authoring Planner

8.7.8 Motivation

So I think motivational speeches and motivational speakers represent the fast food version of the mentioned concepts. My advise – being coherent with the opening quote – is to be suspicious with speakers, who claim that you can achieve (usually material) success without major failures, crises and hard work. You will need to learn, and you will learn the most by failures. If you never fail, then you were not ambitious enough. As you will learn and grow (or simply by being in a new environment) your value system will at least partially change. This will most probably induce an existential crisis. This can be painful, but it can cause a leap in your growth. If somebody says, that you should not experience sadness, and gloominess, and you should change yourself to achieve material success, run.

9 Replication manual

9.1 Used tools

This document was made by Overleaf, which uses LaTeX. One can find nice tutorials on Overleaf, to learn how to use it. The source of the project can be found on:

- Overleaf
- GitHub (main.tex)
- Wayback Machine

9.2 Licensing

- Adapt — remix, transform, and build upon the material for any purpose, even commercially.

See the full license here.

9.3 Instruction

If you write your own document, consider to include a **Replication manual.**

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