The Nordic
Engineering Hub

How can we develop technical skills in the Nordic region?

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Why?

The overarching goal is to create a platform for knowhow sharing, a nexus for generation and dissemination of new ideas on STEM education.

KTH, Aalto University, Aalborg University, Reykjavik University, Stavanger University, NORDTEK, ANE

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The aim of NordEnHub is to:

- Stimulate the development of engineering education in the Nordic region
- Act as a source of expertise for politicians and policy makers
- Establish a network of stakeholders in engineering education
- Raise awareness and attractiveness of STEM education throughout the education chain
- Provide a platform for STEM projects

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NordEnHub is financed by:

- Nordiska ministerrådet
- Nordplus
- Partneruniversiteten
- Erasmus +

Co-funded by the
Erasmus+ Programme
of the European Union

Mapping prerequisites for Engineering education

In order to work effectively across borders, the project has mapped the education systems in the different Nordic countries, including the Baltic States.

Universities offering engineering education are also named in this mapping report.

Available at: www.nordenhub.org

Comparision of School systems within the Nordic Region: Denmark

The Ministry of Education, the Ministry of Higher Education and Science, the Ministry of Culture and the Ministry of Defence manage the Danish education system. Compulsory education is from 6 to 16 years and then students can attend academically oriented programs (upper secondary schools) or vocational education programs. Most academic programs take 3 years to complete. Higher preparatory examination (HF) takes 2 years and vocational education programs can take 1.5 to 5.5 years but are usually 3.5 to 4 years long. The academic programs prepare students for higher education where there are three types of educational institutions: business academies that offer short-cycle programs; university colleges that offer medium-cycle programs and universities that offer long-cycle programs. The figure below shows the structure of the Danish school system.

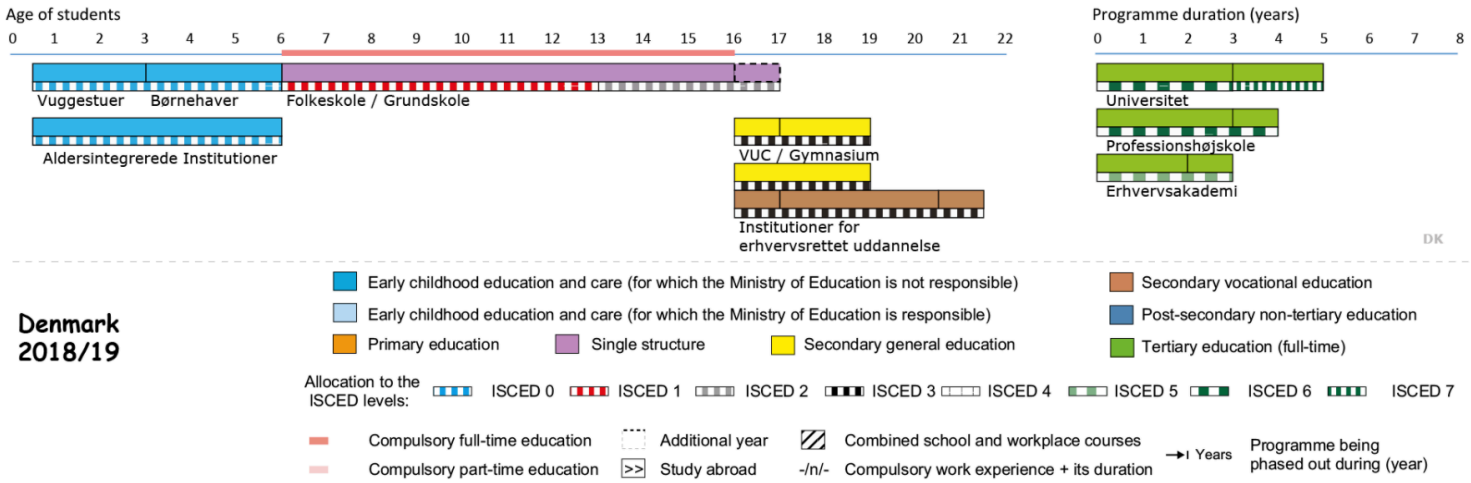


Figure: The structure of the Danish school system. (https://eacea.ec.europa.eu/national-policies/eurydice/content/denmark_en)

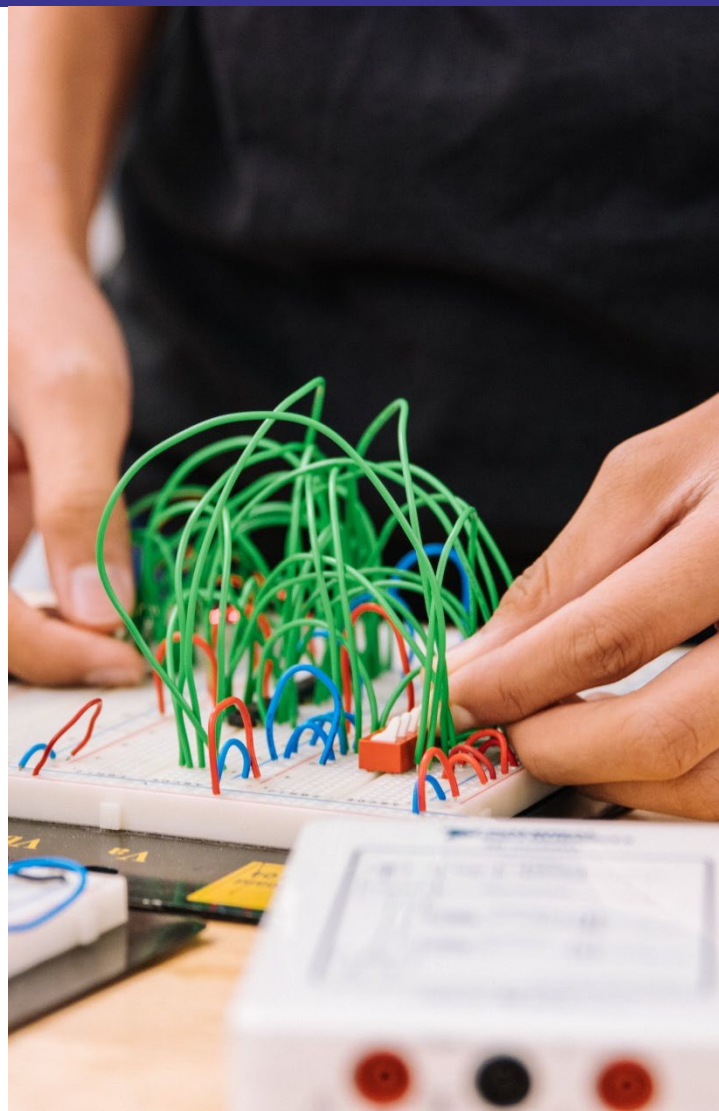
Forming interest for STEM among youth

In order to identify ***best-practice cases for outreach activities organized by universities***, a thorough review of what has been done in each country so far has been done.

11 cases have been analysed,
4 strategies found.

- **awareness**
- **competence**
- **role modelling**
- **play**

STEM = Science, Technology, Engineering, Mathematics



Promoting experiences of autonomy in Nordic STEM outreach activities

Five videos presents advises to someone who wants to develop initiatives for attracting adolescents to STEM:

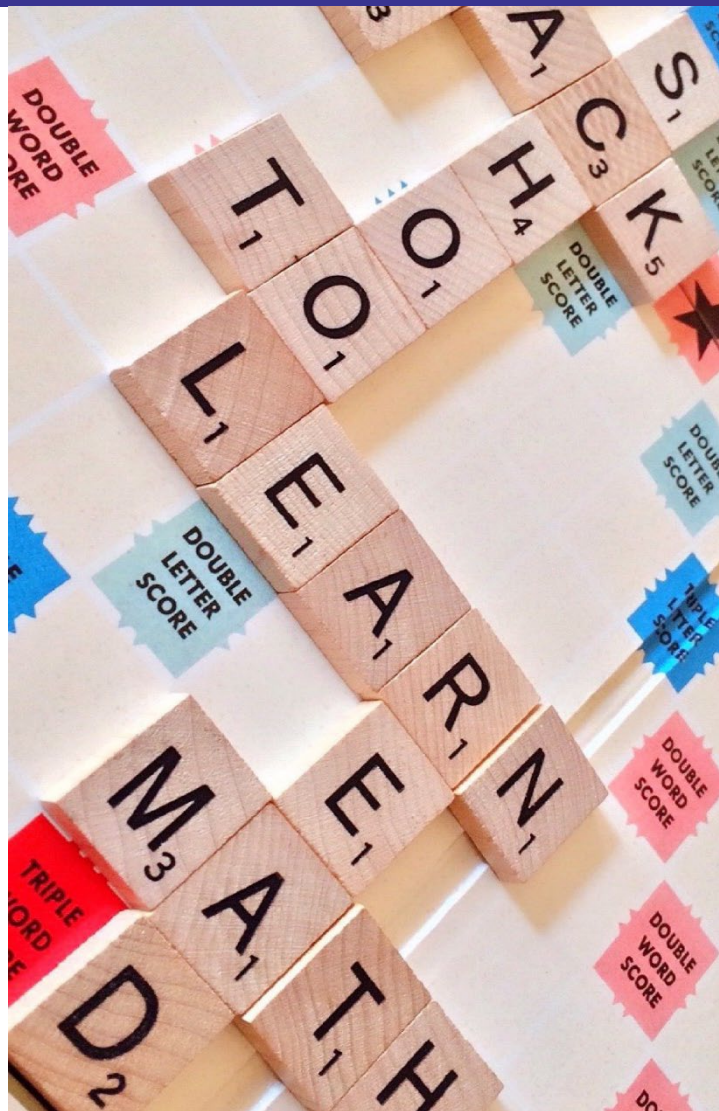
Hands on working

Enjoyable learning

https://drive.google.com/drive/folders/1l1iv51AFr1u09IGcjEpss7hDzYEY5OIG

Life Long Learning

The study aimed at mapping strategies and current practices of continuing education. In addition, the objective was to identify trends in cross collaboration and to find new paradigms for knowledge flow between Nordic universities, industries and professional engineers.



Short presentation of:
Results from the explorative interviews of 10 universities regarding continuous training

- There are typically two possible organizations for CE at Nordic universities. Which is either a university internal unit or external units, such as holding companies.

- There is a notable difference in whether strategies for CE have been drawn up at the various universities.

- Some respondents say that competences and CE are really on the political agenda. But that there must be developed a new model – also for whom to pay.

- There is a general consensus that there is a need and demand for continuing education from universities.

Future Engineering Education 2030

This subproject consists of a comparative study of engineering education practices and stakeholders' ideas of tomorrows engineering education.

Interviews with 20 professors from 5 Nordic universities

Digitalisation

New disciplines formed due to digitalization that may be even more popular:

- Bioinformatics, Mechatronics

Distribution of digitalisation knowledge:

- Software used in industry needs to be practiced in courses
- Modelling and simulations important tools
- The focus on robotization demand better competence in programming within most engineering fields

ACTORS affecting development of education:

- Society
- Industry

Who will teach?

- PhD students, other experts, not the professors(?)

"Up to now, we have mostly used computers to do what we could already do manually, but faster. But now we see innovations where computers bring about brand new things"

(Norway 1)

Digitalisation

“Internet of Things or automated driving, or artificial intelligence; billion after billion has been invested and companies are looking for prospective future markets.

There's an extreme technology push for new markets. And then there's an extreme push for getting hold of the right competence.”

(Sweden 1)

The role sustainable development plays differs a lot among the universities investigated

"… talking about sustainable development, it's clear we are in the heart of that. So, I think for what I'm doing, it's really sustainable biotechnology and so on. So, we don't really see major changes (coming up), we are in the changes."
(Denmark 3)

"… and I think that will be more in the years to come, much more ... now when you're going to construct a building, you think costs. That's the main issue. Cheapest as possible. But I think the environment and the CO2 footprint will be more significant and not only price will be the issue."
(Norway 1)

"… it's also the 17 sustainability (goals)... I mean,... how does that create value? This we have to work (on) some more systematically in the educational programs."
(Denmark 4)

Barriers for implementing SD in educational programs:

"One of the professors express it as 'teacher get tired' and they 'want to be left alone' not having to work with the centre for Sustainablility."

(Finland 1)

"Today, we see a trend where focus on SD also means more general programs, something that can prevent us from training the specialist skills that are also needed for us to be able to solve the sustainability goals".

(Sweden 4)

Expected change when it comes to education in general

- Expectation of the need of more **Y** or **T-shaped** engineers instead of only **I-shaped** engineers
- Education is expected to be more flexible, both when it comes to where, when and how
- The role of the university may change – controlling/valuing experiences/knowledge rather than giving the courses

Expected change when it comes to pedagogical approaches

- There is a common understanding that the old fashion way using essentially lectures and tests in the end of the course is not the most efficient way of teaching

- Increase in prevalence of problem based courses (PBL, CDE etc.)

- Focus on interdisciplinary courses/approaches

"I hope it increases (interdisciplinary courses). It may not be in every course … It may be a housing project or another, but when one thinks of heat exchanger and solar energy, then one thinks of another social sustainability, and rent setting and availability and inclusion."

(Sweden 3)

Interviews of 8 managers from ten different cooperations

Short presentation of:
Results from the interviews with 10 corporations

- Sustainability is very important for the stakeholders. More specifically, they need competence in life cycle analysis, climate change, and low carbon solutions.
- Digitalisation/Industry 4.0: all stakeholders consider digitalisation as important. Some of them see digitalisation primarily as a tool or enabler for sustainability.
- The stakeholders need competence in, for example, software, cyber security, AI, cloud technology, big data, digital twins, and robotics. They also have a need for digital skills in general and, therefore, they suggest aiming for stronger integration of digitalisation and digital tools into all engineering programmes.
- Other competence needs include commercialization, future business models, and teamwork skills. Moreover, the stakeholders ask for students with a holistic understanding, broader perspectives, and an understanding of how things are connected.

Suggestions for Future Engineering Education

- Sustainability and digitalisation should be included in all engineering programmes.
- Less silo-thinking and more collaboration across programmes in engineering education to achieve a holistic understanding.
- The students need to work in teams in projects and they need to learn to work together.
- The students need to develop as human beings and consequently, the stakeholders recommend to continue with physical meetings where students work together. The stakeholders do not consider digital meetings to be sufficient to fulfil this need.

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Thanks!

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