

# Computational Empowerment in K-12 Education

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Why is the evolution of education predominantly driven by technological advancements rather than being guided by didactic visions?

Ole Sejer Iversen  
Professor, Aarhus University

# ChatGPT May Lead To The Downfall Of Education And Critical Thinking



## Hver fjerde lærer har oplevet snyd med ChatGPT

Tech

### Hver tiende studerende har snydt til eksamen med ChatGPT

<https://www.yahoo.com>

PUBLICERET Torsdag 15. juni 2023 - 19:30 SENEST OPDATERET

## Fynsk DF'er: Sluk internettet under eksaminer gå tilbage til pen og papir

Med lanceringen af ChatGPT deler kunstig intelligens vandene. Dansk Folkeparti har stillet et beslutningsforslag om at ændre skriftlige eksaminer på.

ans. og bekvmmringen for snyd ved afgangsprøverne

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ARTIFICIAL INTELLIGENCE

## ChatGPT is going to change education, not destroy it

The narrative around cheating students doesn't tell the whole story. Meet the teachers who think generative AI could actually make learning better.

By Will Douglas Heaven

April 6, 2023



# Computational Empowerment: A didactic vision for K-12 education

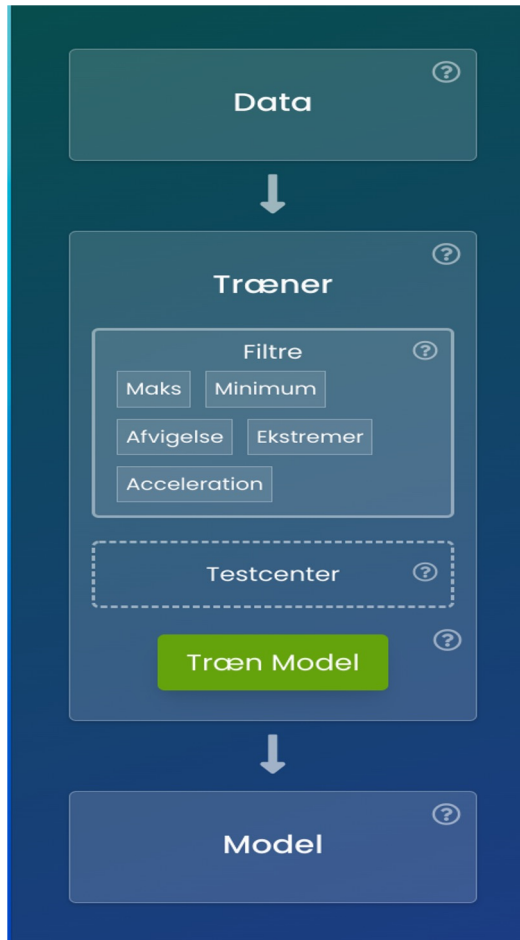
“Computational empowerment denotes the process in which children, as individuals and groups, develop the skills, insights and reflexivity needed to understand digital technology and its effect on their lives and society at large, and their capacity to engage critically, curiously and constructively with the construction and deconstruction of technology”



- A. active engagement & embodiment
- B. deep learning
- C. transformative agency

Iversen, O. S., Smith, R. C., & Dindler, C. (2018, August). From computational thinking to computational empowerment: a 21st century PD agenda. In Proceedings of the 15th participatory design conference: Full papers-Volume 1 (pp. 1-11).

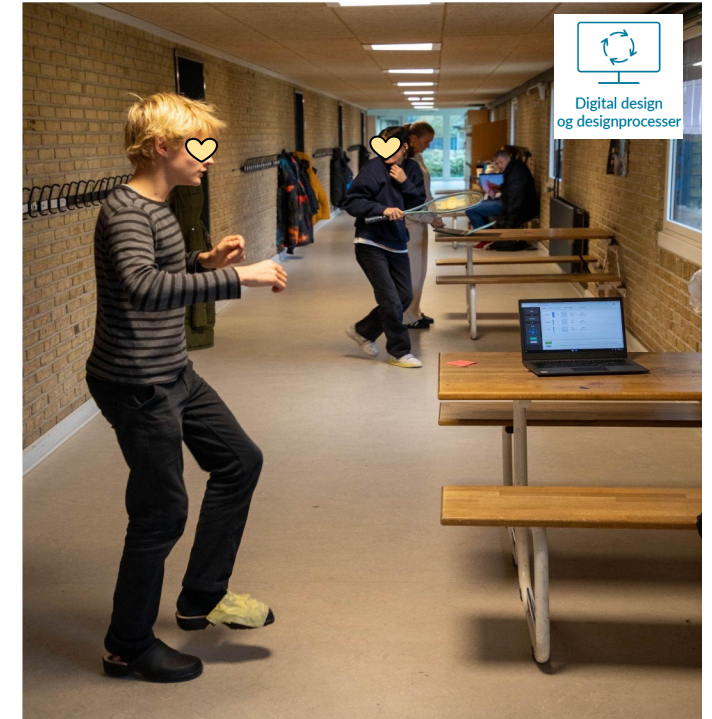
# 8th grade: Designing Machine Learning ... and its consequences



Creating a Data set



Training the algorithms



Evaluating the computer model

Kaspersen, M. H., Bilstrup, K. E. K., Van Mechelen, M., Hjort, A., Bouvin, N. O., & Petersen, M. G. (2022). High school students exploring machine learning and its societal implications: Opportunities and challenges. *International Journal of Child-Computer Interaction*,

## High school: Computer modelling for biotech learning



“ Participants in the intervention group showed statistically significant improvements in their biological and computer modelling knowledge ”

Line Have Musaeus, Deborah Tatar & Peter Musaeus (2022) Computational Modelling in High School Biology: A Teaching Intervention, Journal of Biological Education, DOI: [10.1080/00219266.2022.2118353](https://doi.org/10.1080/00219266.2022.2118353)

# 1th grade – University: Model for understanding digital technologies (intentionality & culture)

|   | Research area                 | Research questions  | Methods of inquiry<br>(examples)   |
|---|-------------------------------|---|--|
| 1 | How is it constructed?        | <ul style="list-style-type: none"><li>• What software and hardware is used?</li><li>• Which materials are used?</li><li>• What other systems does the technology connect to?</li></ul>  | <ul style="list-style-type: none"><li>• Disassemble technology</li><li>• Study documentation to understanding hardware and software</li></ul>                                    |
| 2 | What is the purpose?          | <ul style="list-style-type: none"><li>• Which activities is it meant for?</li><li>• Which actions does it support?</li><li>• How does the user interface make functions available to the user?</li><li>• What is the intended use?</li></ul>          | <ul style="list-style-type: none"><li>• Describing what the technology expects of the user?</li><li>• Mapping functions and interactive features</li></ul>                       |
| 3 | How is it used?               | <ul style="list-style-type: none"><li>• How do people actually use it?</li><li>• How do people experience using it?</li><li>• How does the technology work in a context?</li></ul>  | <ul style="list-style-type: none"><li>• Interviewing people who use the technology.</li><li>• Observing situations in which the technology is used.</li></ul>                    |
| 4 | Which values does it reflect? | <ul style="list-style-type: none"><li>• Who is interested in the technology being used?</li><li>• Which world-view and ideal user does the technology reflect?</li><li>• What kind of actions and activities does the technology encourage?</li></ul> | <ul style="list-style-type: none"><li>• Mapping people and actors who are interested in the technology and its use.</li><li>• Redesigning based on contrasting values.</li></ul> |
| 5 | What are the consequences?    | <ul style="list-style-type: none"><li>• What does the technology do for individuals, groups and society?</li><li>• What is the role of the technology in our culture?</li></ul>   | <ul style="list-style-type: none"><li>• Studying how an institution or practice has changed over time because of technology.</li></ul>   |
| 6 | What are the arguments?       | <ul style="list-style-type: none"><li>• Which practical, emotional or ethical reasons are given for buying or using the technology?</li></ul>   | <ul style="list-style-type: none"><li>• Studying documentation and commercial material.</li><li>• Talking to designers or companies behind the technology</li></ul>              |



Christian Dindler, Ole Sejer Iversen, Mikkell Hjorth, Rachel Charlotte Smith, Hannah Djurssø Nielsen, DORIT: An analytical model for computational empowerment in K-9 education, International Journal of Child-Computer Interaction, Volume 37, 2023, 100599, ISSN 2212-8689, <https://doi.org/10.1016/j.ijcci.2023.100599>

# Teknologi- forståelse

## Måloversigt



Digital  
myndiggørelse

### Digital empowerment

Critical, reflexive and constructive examination and understanding of possibilities and consequences of digital artefacts.

**Analysis of technology—intention and use | Evaluation | Redesign**



Digital design  
og designprocesser

### Digital design and design processes

Organisation and implementation of iterative and incremental design processes considering the context of future use.

**Problem framing | Ideation | Prototyping | Argumentation**



Computational  
tankegang

### Computational thinking

Analysis, modelling and structuring of data and data processes for automatic execution by a computer.

**Data | Algorithms | Structuring | Modelling**



Teknologisk  
handleevne

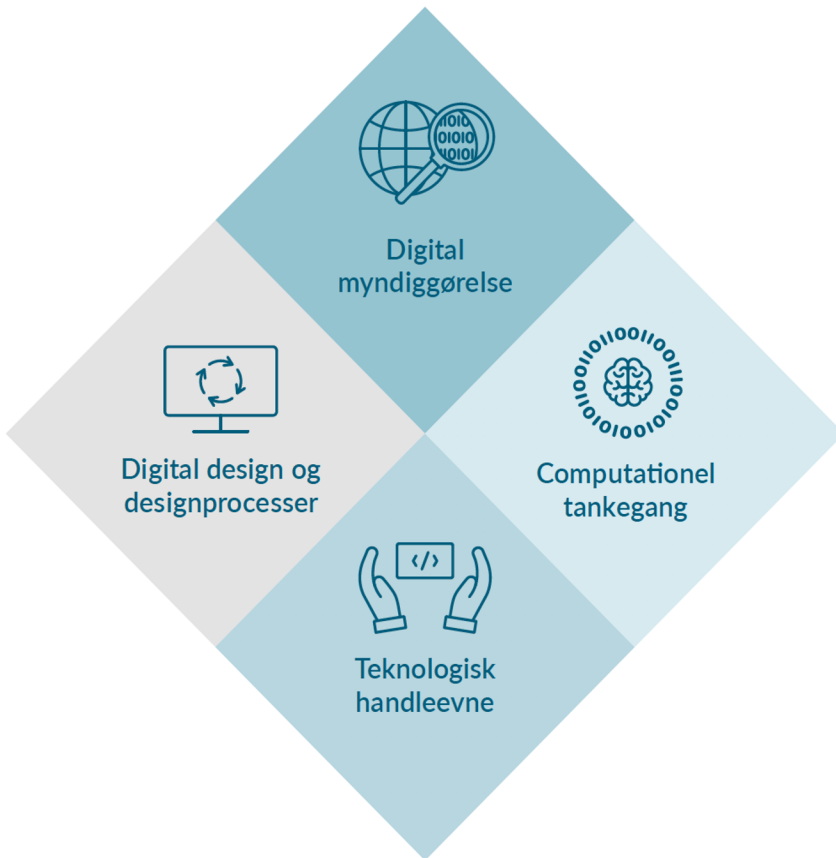
### Technological knowledge and skills

“Mastery” of digital technologies (computer systems and networks), associated languages and programming.

**Programming | Computer systems | Networks | Security**

<https://www.uvm.dk/-/media/filer/uvm/aktuelt/pdf18/181221-laeseplan-teknologiforstaelse.pdf>

Students' expectation to higher education will significantly changes over time...



### **DIGITAL EMPOWERMENT**

The student can act with judgment in complex situations that concern the importance of digital artefacts for the individual, community and society

### **DIGITAL DESIGN AND DESIGN PROCESSES**

The student can organize and carry out iterative design processes and create digital artefacts that solve complex problems relevant to the individual, community and society.

### **COMPUTATIONAL THINKING**

The student can reflect on and apply computational thinking to problems from the outside world.

### **TECHNOLOGICAL MASTERY**

The student can assess, choose and use digital technologies in a qualified manner in authentic situations.

Regeringen

Forberedt på fremtiden II

# Frihed og fordybelse

- et kvalitetsprogram for folkeskolen

Technology comprehension is introduced as a mandatory subject in existing subjects and as an elective course in lower secondary education (Oct 2023)

DKK 160 mill is dedicated to the implementation of technology comprehension in K-9 education (Nov 2023)

Regeringen

# Danmarks digitaliseringsstrategi

Ansvar for den digitale udvikling



## Informatics education at school in Europe

Eurydice report



11 core subject areas - are all covered in the Danish curriculum

Erasmus+  
Enriching lives, opening minds.

School education

Higher education  
Vocational education and training  
Adult education



VIDENSCENTER FOR DIGITAL  
TEKNOLOGIFORSTÅELSE

## Informatics Reference Framework for School

February 2022



informatics for all



## Questions to consider

Why is the evolution of education predominantly driven by technological advancements rather than didactic visions?

What would happen to our educations (and assessment) if we accept that digital technologies are an integral part of learning environments?

How do we engage all teachers in integrating digital technology into their subject matter teaching?



# VIDENSCENTER FOR DIGITAL TEKNOLOGIFORSTÅELSE

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fonden

VILLUM FONDEN



## PROGRAM FOR **ÅBNINGSKONFERENCEN** Mandag d.4.12.2023 kl. 13:30 til 17:00

- Velkommen v. Styregruppeformand, Jakob Harder (KP) & styregruppemedlem, Maja Horst (AU)
- Børne- og undervisningsminister, Mattias Tesfaye
- Vicecenterleder, Lars Bo Andersen (KP)
- Formand for Danske Skoleelever, Laura Drachmann Poulsen
- Centerleder, Ole Sejer Iversen (AU)
- Formand for Danske Gymnasieelever, Asger Kjær Sørensen
- Programdirektør, Villum Fonden, Agi Csonka
- Centerleder, Ole Sejer Iversen (AU)
- Bobler & snack (reception)



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