Why Data Matters…

On the importance of data competencies

Marathon, 02.07.2023

Erasmus+

Ruhr West University of Applied Sciences

Hochschule Ruhr West

Ruhr West University of Applied Sciences

History

- Founded in 2009
- Public institution, regional development
- 6000 students, 100 professors and growing ☺
- Western Ruhr area (Bottrop, Mülheim)

Focus Areas

- Civil Engineering
- Business Administration - International Trade Management & Logistics
- Mechatronics
- Human-Machine-Interaction
- Business Information Systems
- Master Programme Business Administration

Glo-Link

Global Learning, Innovation and Knowledge Management

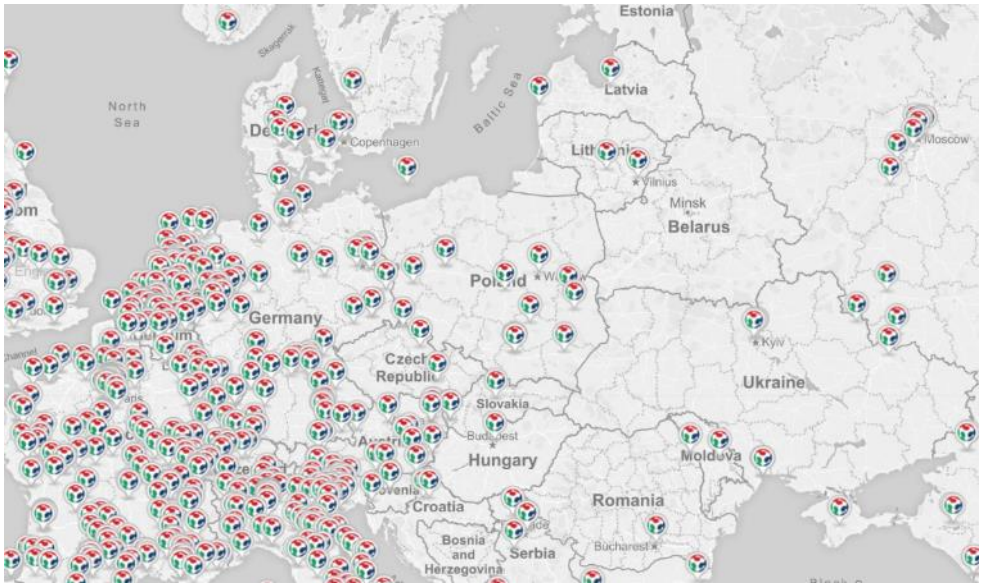
Researching Processes and Systems in a Global Context

Focus Areas

- Global Process Management
- Collaborative Innovation Management
- Competence Management, Knowledge Management and E-Learning
- Open Innovation, Open Educational Resources

HRW FabLab

How to Make (Almost) Anything



Source: https://www.fablabs.io/labs/map

- Fabrication Laboratory: „How to Make (Almost) Anything“
- Initiative from Professor Neil Gershenfeld at the Massachusetts Institute of Technology.
- 1750 FabLabs around the world (in more than 100 countries)
- HRW FabLab run by Prof. Dr. Michael Schäfer
- http://fablab.hochschule-ruhr-west.de/content/index_eng.html
- Typical equipment: Various 3D-printers (used for PLA / ABS), Laser-CNC-cutter, Bandsaw, Drilling machines and pedestals; Arduino. shields, sensors, Raspberry Pi, Panda-Board, Beagle-Bone, Raspberry Pi-Cameras…growing daily ☺

Glo-Link

Global Learning, Innovation and Knowledge Management

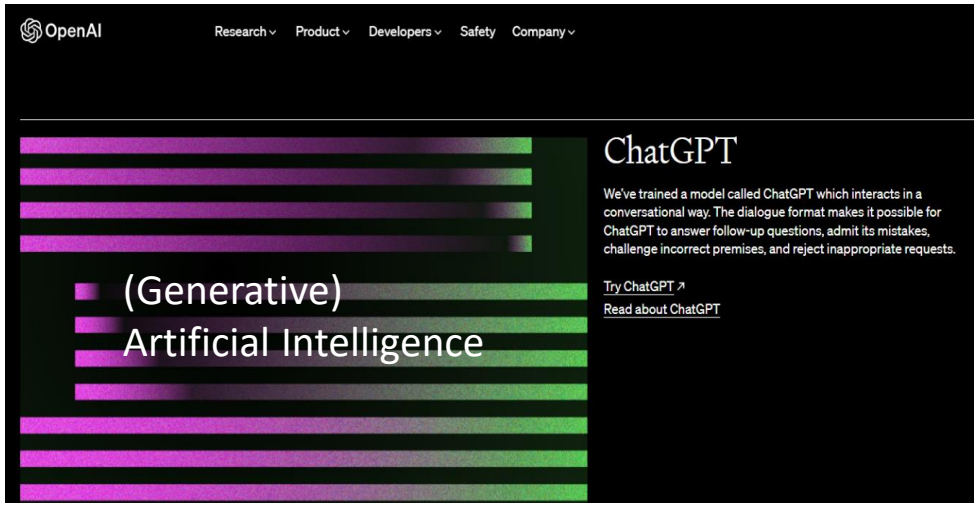
Researching Processes and Systems in a Global Context

Projects

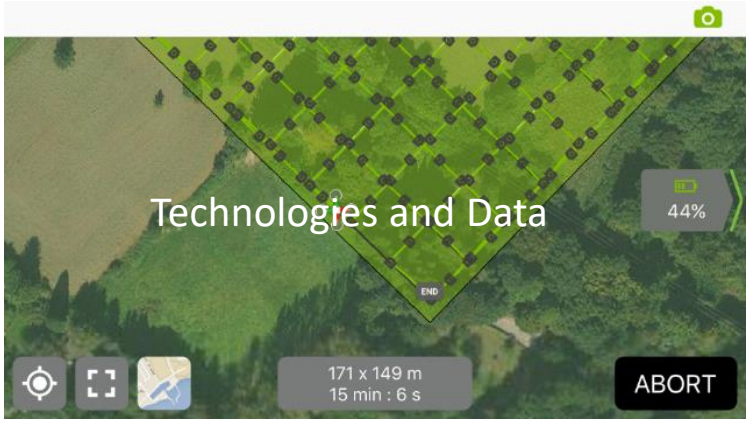
- AIware: the AI-aware classroom
- ProNet Handwerk: Competency development for VET
- Emscher Lippe[4]: Inclusive and Social Innovation / Competence Development
- CoTA: Computational Thinking and Acting in Schools
- ÖWR: Public Knowledge Resources
- EAGLE: Enhanced Government E-Learning
- Play4Guidance: Simulation Game for Innovation and Entrepreneurship
- iGOAL: startup innovation competencies in intergenerational and global contexts

Digital Transformation Challenges

https://commons.wikimedia.org/wiki/File:Factory_Automation_Robotics_Palettizing_Bread.jpg



https://openai.com/



Some questions…

Causality vs Correlation

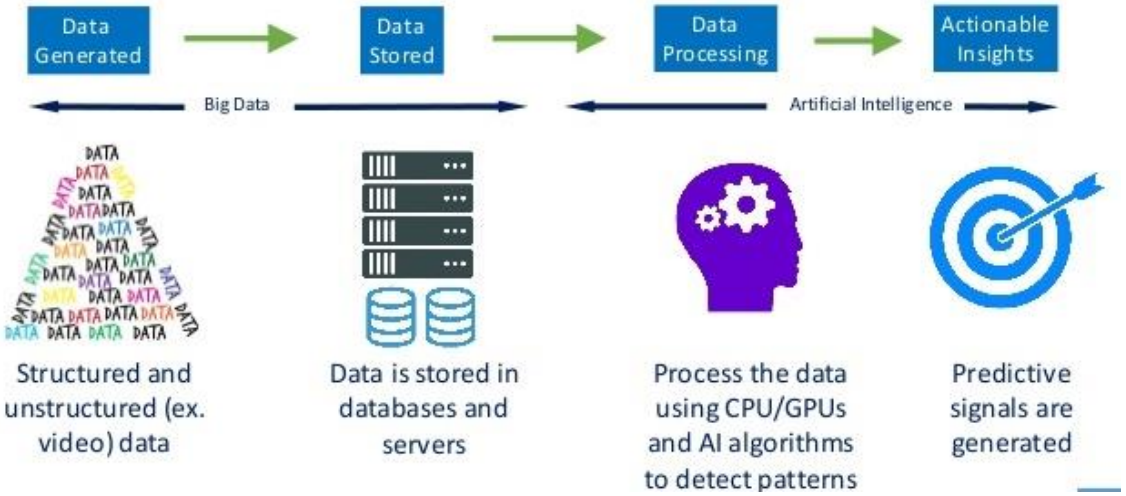
- Ice cream sales cause violent crime
  - hot temperatures as the third variable

- Smoking protects against COVID-19 – less smokers hospitalized…
  - No causation, maybe smokers hesitate to be hospitalized

- Low Vitamin D levels cause depression
  - Unknown reasons, maybe bidirectional causality

Data & AI

- Data as the main input for AI



https://devopedia.org/artificial-intelligence

- Open questions:
  - Training data?
  - Reasoning?
  - Privacy?
  - Ethics?

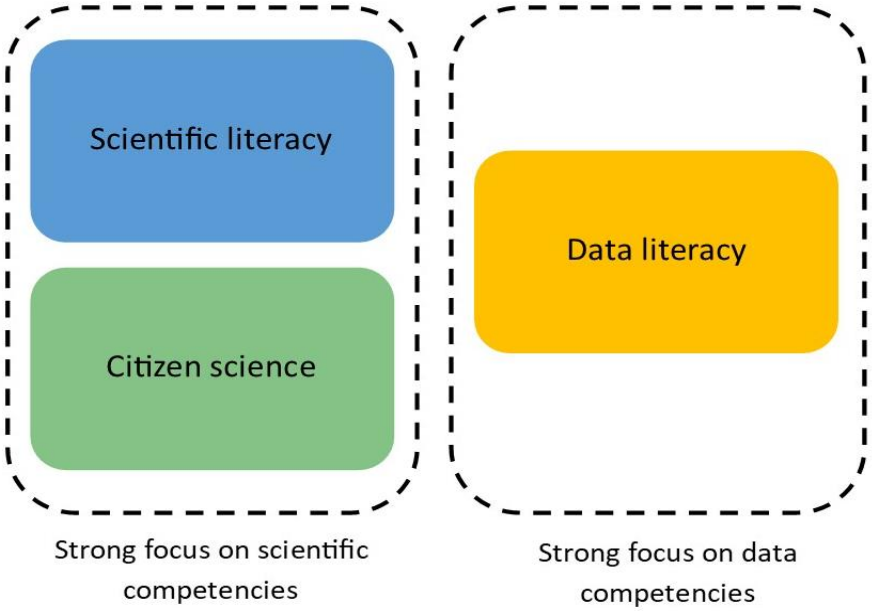
The Key Question

Why are data competencies the key for future generations?

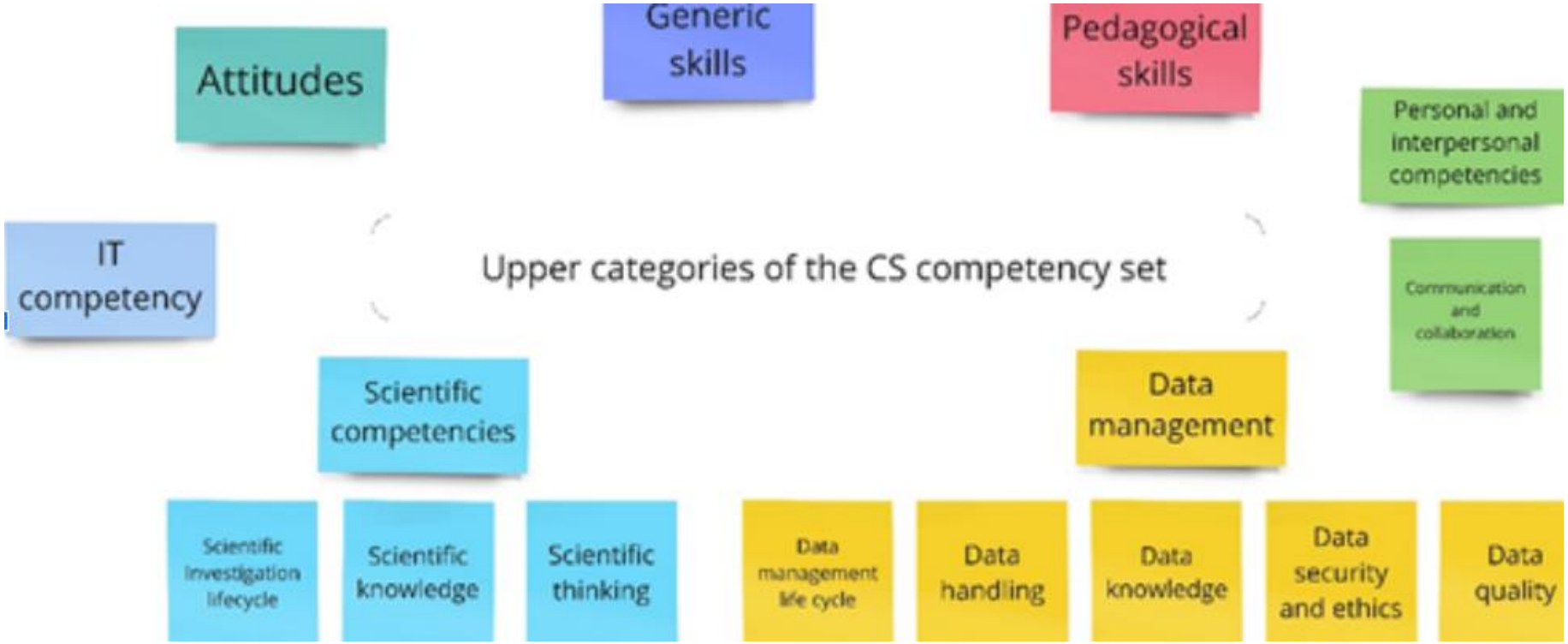
- Which data competencies are important?
- How to include them in the curriculum in schools?
- How to utilize Citizen Science projects?

Citizen Science & Data Competencies

- Scientific thinking
  - Formulating research questions
- Data handling
  - Interpreting data
- Attitudes
  - Positive attitude towards science
- IT competencies
  - Programming and data handling
- Communication
  - Community involvement
- Sustainability
  - Socially responsible issues (eg food waste)



Citizen Science & Data Competencies



- https://fabcitizen.eu/wp-content/uploads/2023/03/O2-FabCitizen-Competency-Framework_202212.pdf

Sample Data Competencies

Data Interpretation	Description	Operational description	Secondary school I Grade 5-6	Secondary school I Grade 7-10	Teachers
	Read & interpret data	I am able to read and interpret data.	Ability to read and interpret data / graphical representations of statistical surveys	Ability to read and interpret data / graphical representations of statistical surveys	Ability to read and interpret data / graphical representations of statistical surveys
	Read and interpret graphical representations of data				
Data Cleaning					
	Clean Data	I am able to clean up data.	Ability to identify outliers	Ability to clean up data.	Ability to clean up data.
Data Transformation					
	Data Representation and Transformation (into information)	I am able to transform data into information and to transform information into decision to drive data-driven decision making.	/	Ability to process information from intra- or extra-informational contexts in appropriate, formalised structures and represent them through data.	Ability to process information from intra- or extra-informational contexts in appropriate, formalised structures and represent them through data.
	Transform information into decision				
	Data-driven decision making				
Data Evaluation					
	Evaluate decisions based on data (&sources)	I am able to evaluate decisions based on data, to evaluate outcomes, to interpret data and use tools for data evaluation.	Ability to evaluate data and interprete data (trends, structure, relations)	Ability to evaluate data and interprete data (trends, structure, relations)	Ability to evaluate data and interprete data (trends, structure, relations)
	Evaluate outcomes				
	Interpret data				
	Data Tools				

- https://fabcitizen.eu/wp-content/uploads/2023/03/O2-FabCitizen-Competency-Framework_202212.pdf

Sample Data Competencies (2)

Communicating with data	Description	Operational description	Secondary school I Grade 5-6	Secondary school I Grade 7-10	Teachers
	Communicating and presenting effectively with data	I am able to communicate and present data effectively.	Ability to present column and bar charts.	Ability to present and communicate different charts and easy statistics (median, mean ...).	Ability to present different charts and statistics.
	Data Presentation				
Critical thinking					
	Critical thinking				
	Verify data / apply critical thinking	I am able to apply critical thinking and to verify data.	Ability to critically assess the significance of representational and work tools for answering questions and examine their relevance for opening up the spatial reality of life	Ability to critically assess the significance of representational and work tools for answering questions and examine their relevance for opening up the spatial reality of life	Ability to critically assess the significance of representational and work tools for answering questions and examine their relevance for opening up the spatial reality of life
Data Access					
	Get / Access data	I am able to access data.	Ability to extract data from analog and digital media offerings.	Ability to extract data from analog and digital media offerings.	Ability to access data
Data Analysis					
	Using data analytics (data analysis)	I am able to apply statistics as e.g trend analysis and do predictions, distinguish between correlation and causality and I am able to analyze data and find insights from data.	Ability to evaluate data and interpretate data (trends, structure, relations)	Ability to evaluate data and interpretate data (trends, structure, relations)	
	Analysis of (classroom) data				
	Trend analysis / Predictions				

- https://fabcitizen.eu/wp-content/uploads/2023/03/O2-FabCitizen-Competency-Framework_202212.pdf

Data Competencies in CS

- Involvement of teachers and students in ALL phases of Citizen Science projects
  - Defining research questions
  - Planning experiments
  - Planning data collection and interpretation

- Basic data competencies in all subjects
  - Not solely in mathematics
  - Improvement of statistical competencies
  - Critical data thinking

- Opening schools
  - CS as a learning & teaching method
  - Communication and collaboration outside the school
  - Community education

Learning Scientific Thinking and Data Management

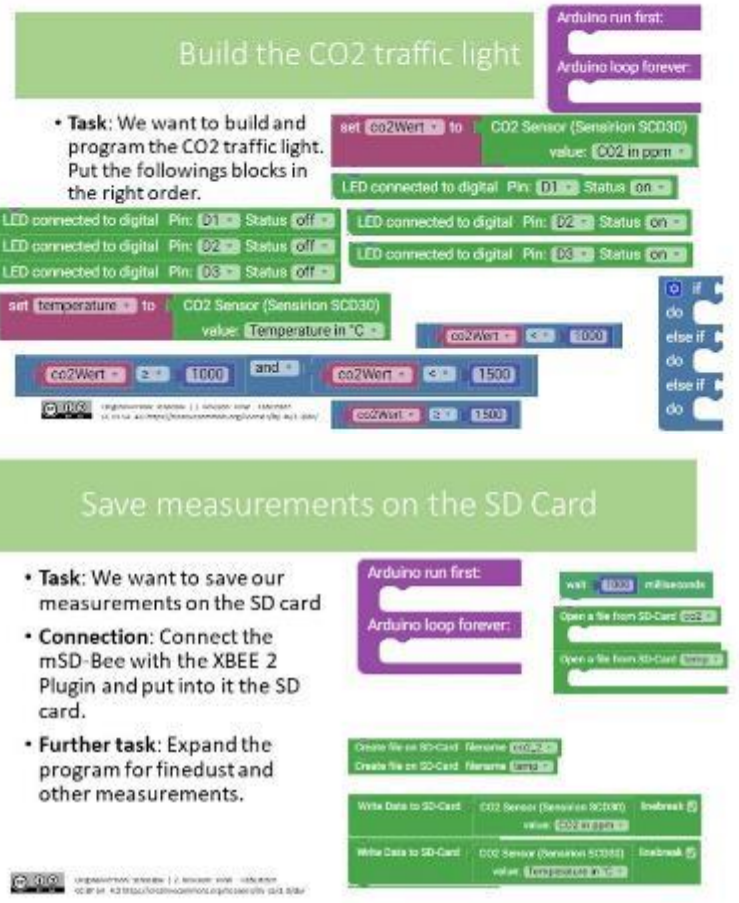
- Using microcontrollers for environmental problems
  - Using Arduino and sensors to measure environmental data, such as CO2 and fine dust
  - Climate data in the stratosphere
  - App development

- **CO2 Traffic Lights**

Learning Scientific Thinking and Data Management

- Arduino / Sense Box
  - Low code environment
  - Block based programming
  - New technologies: sensors
  - Data recording

- Use for kids
  - Basic programming
  - Basic data analysis (e.g. averages, outliers)
  - Basic data interpretation



- More: https://fabcitizen.eu/2021/11/10/sensebox-co2trafficlight/

Summary

- Data Competencies are the key to understanding and surviving digital transformation
- Data Competencies are essential to understand Artificial Intelligence solutions

- Citizen Science is a promising method for schools
- Citizen Science can improve data competencies of communities

- CS projects should be promoted and incorporated on all school levels
- CS good practices should be shared across the globe!

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Questions and Comments???

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