Philipps Universität Marburg

Pädagogische Hochschule HEIDELBERG University of Education

KI in der Hochschullehre

Vom stochastischen Papagei zum allwissenden Lernbegleiter?

16.11.2023, Philipps Universität Marburg

Teaching Futures – Zukünfte der Lehre

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Slides als Download

Download verfügbar für 1 Woche nach dem Vortrag!

SCAN ME

https://kalz.cc/notes/pum23

Disclaimer

Für diesen Vortrag wurden keinerlei KI-Werkzeuge eingesetzt (nicht zur Ideengenerierung, Strukturierung oder Zusammenfassung o.ä.)

Struktur

01 **KI**
vor und nach LLMs

02 **KI in der Bildung**
vor und nach LLMs

03 **Das didaktische Feld**
der Hochschullehre

04 **Herausforderungen**
der Hochschuldidaktik im Zeichen von KI

05 **Reflexion**
und Ausblick

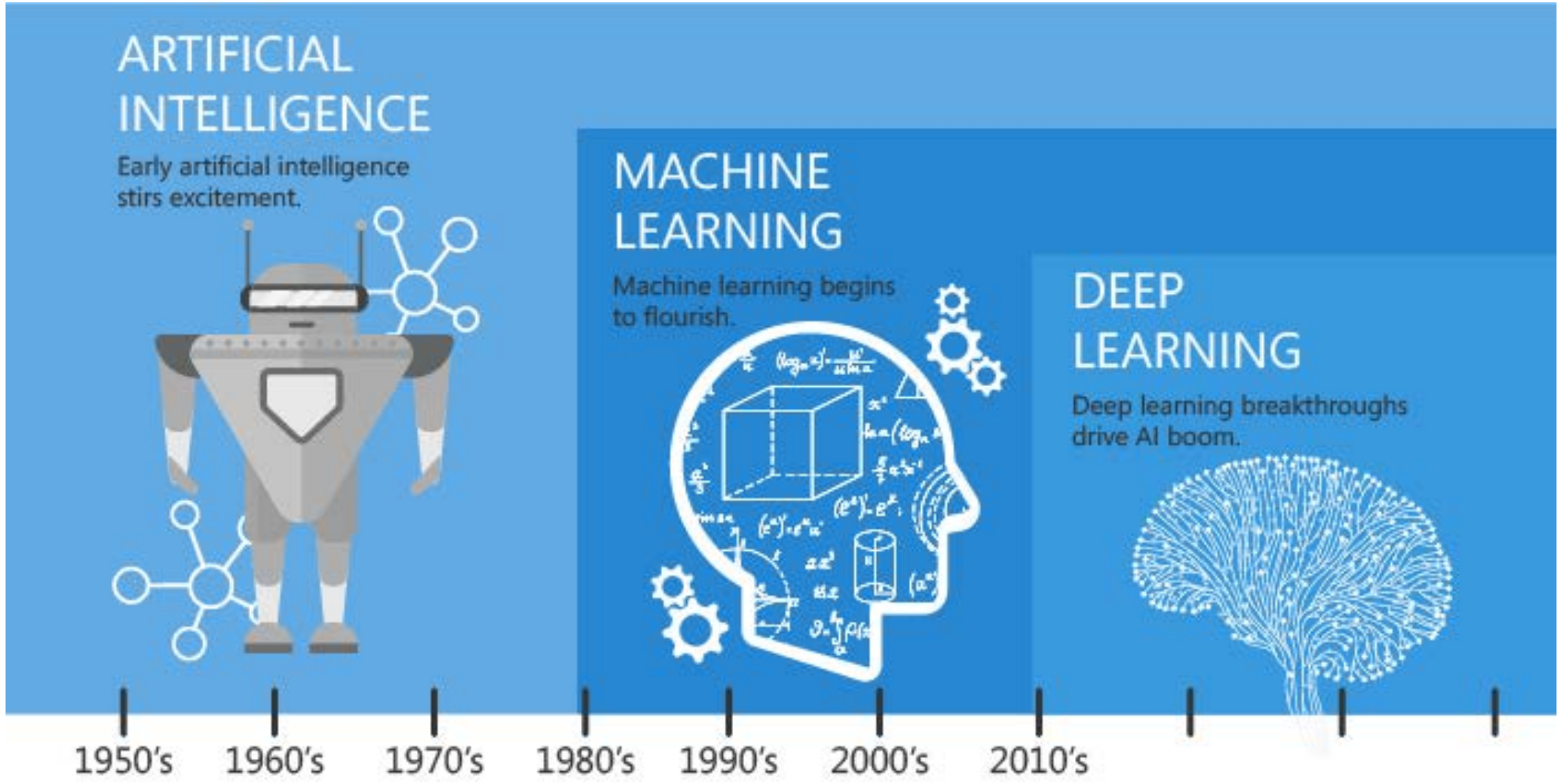
Pädagogische Hochschule HEIDELBERG University of Education

01

KI

vor und nach LLMs

KI – was ist das?



Since an early flush of optimism in the 1950's, smaller subsets of artificial intelligence - first machine learning, then deep learning, a subset of machine learning - have created ever larger disruptions.

Rev.com, 2020

KI – frühe Beispiele: ELIZA (1966)

Eliza

Eliza [Weizenbaum, 1966] simuliert einen Humanistischen Psychotherapeuten [Rogers]. Weizenbaums Skript bestand als eines der ersten KI-Programme einen eingeschränkten Turingtest. Der Name Eliza entstammt der gleichnamigen Hauptrolle in Shaws »Pygmalion«.

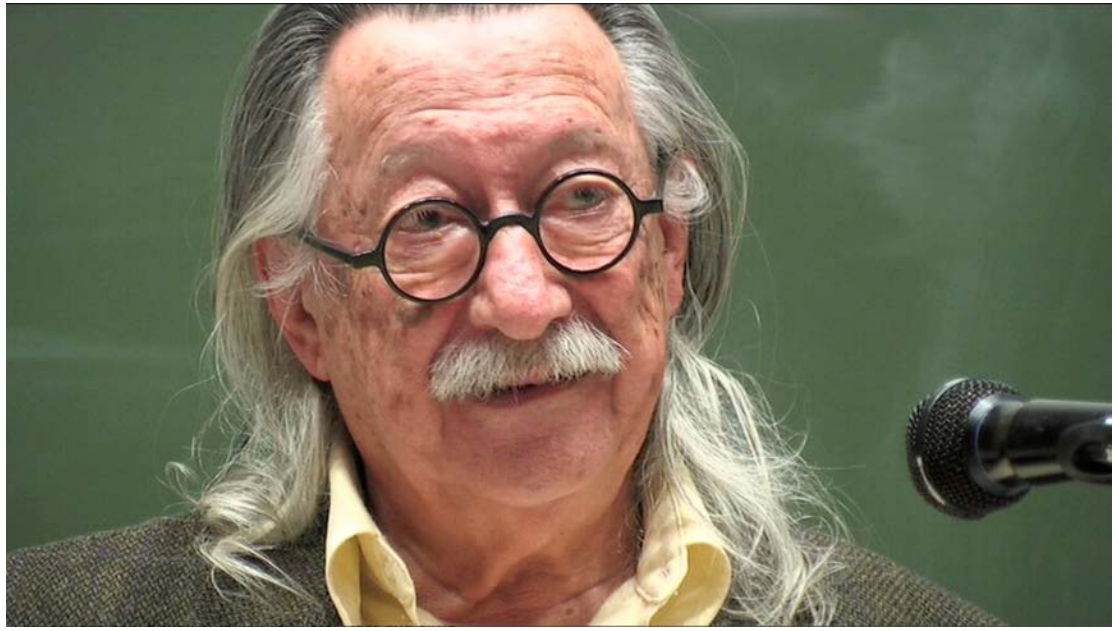
Um mit Eliza zu sprechen, stellen Sie sich vor, Sie sind unglücklich, ängstlich o. ä. und Eliza ein Therapeut. Eliza ist allerdings nicht besonders intelligent …

Im Gegensatz zur englischen Version beherrscht der deutsche Klon auf Grund der schwierigen Wortflexion im Deutschen einen geringeren Wortschatz.

Hinweis: Spaßorientierten Zeitgenossen seien Sina oder Tom empfohlen.

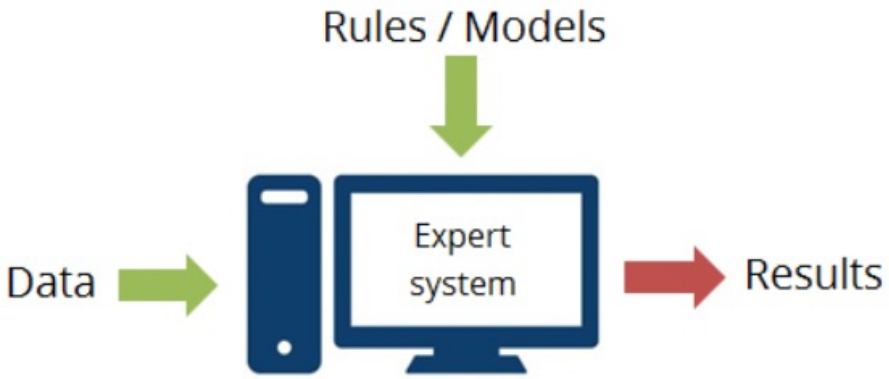
Fragen Sie mich

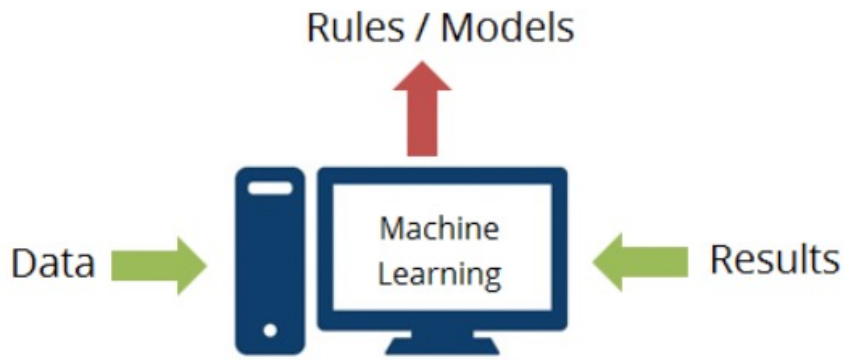
Schön, fahren Sie fort.



By Peter Haas@Flickr

KI – was ist das?





Council of Europe, 2022

Allgenwärtige KI

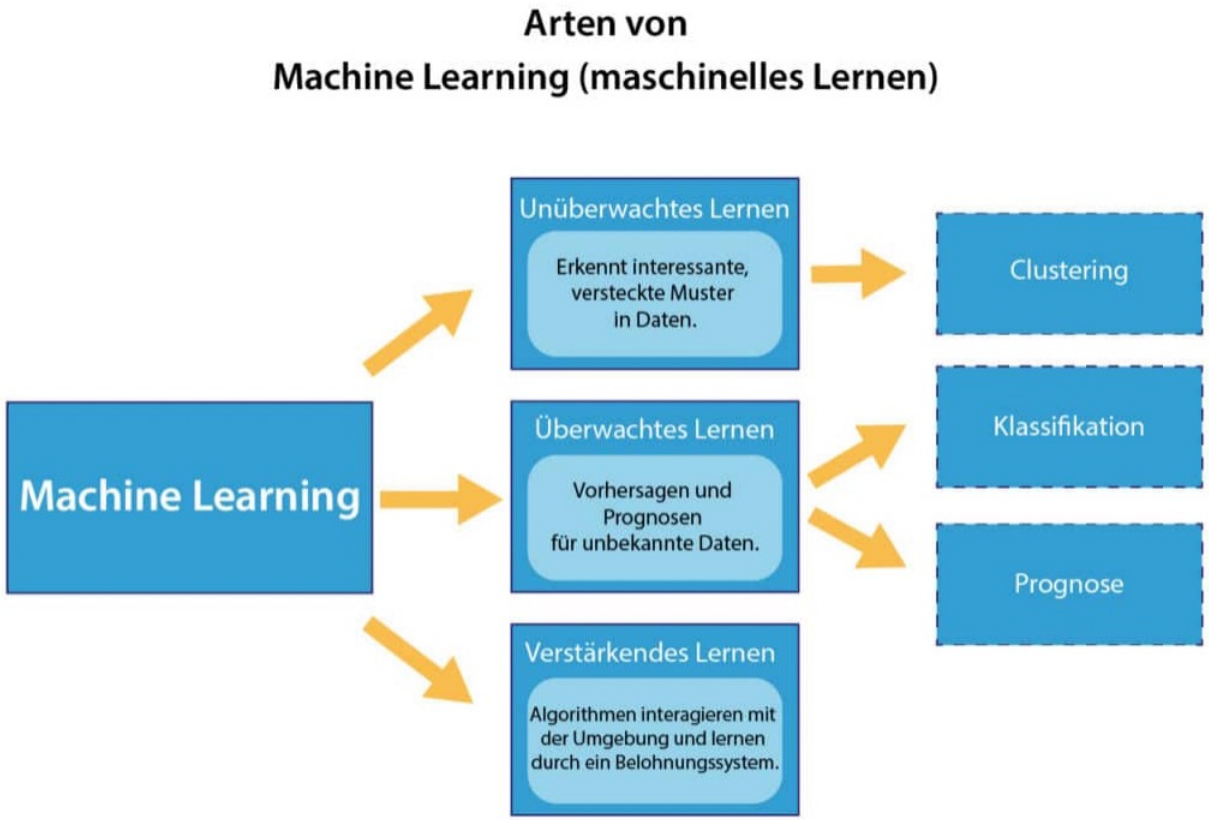
Sprachassistenten

KI-Technologien

TECHNOLOGY	DETAILS	MAIN AI TECHNIQUES	DEVELOPMENT	EXAMPLES
Natural language processing (NLP)	AI to automatically generate texts (as in auto-journalism), and interpret texts, including semantic analysis (as used in legal services and translation).	Machine learning (especially deep learning), regression, and K-means.	NLP, speech recognition, and image recognition have all achieved accuracy in excess of 90%. However, some researchers argue that, even with more data and faster processors, this will not be much improved until a new AI paradigm is developed.	Otter[12]
Speech recognition	NLP applied to spoken words, including smartphones, personal assistants, and conversational bots in banking services.	Machine learning, especially a deep learning recurrent neural network approach called long short-term memory (LSTM).		Alibaba Cloud[13]
Image recognition and processing	Includes facial recognition (e.g. for e-passports); handwriting recognition (e.g. for automated postal sorting); image manipulation (e.g. for deep-fakes); and autonomous vehicles.	Machine learning, especially deep learning convolutional neural networks.		Google Lens[14]
Autonomous agents	Includes computer game avatars, malicious software bots, virtual companions, smart robots, and autonomous warfare.	GOFAI and machine learning (for example, deep learning self-organizing neural networks, evolutionary learning and reinforcement learning).	Research efforts are focusing on emergent intelligence, coordinated activity, situatedness, and physical embodiment, inspired by simpler forms of biological life.	Woebot[15]
Affect detection	Includes text, behaviour and facial sentiment analyses.	Bayesian networks and machine learning, especially deep learning.	Multiple products are being developed globally; however, their use is often controversial.	Affectiva[16]
Data mining for prediction	Includes financial predictions, fraud detection, medical diagnoses, weather forecasting, business processes and smart cities.	Machine learning (especially supervised and deep learning), Bayes networks and support vector machines.	Data mining applications are growing exponentially, from predicting shopping purchases to interpreting noisy electroencephalography (EEG) signals.	Research project[17]
Artificial creativity	Includes systems that can create new photographs, music, artwork, or stories.	Generative adversarial networks (GANs), a type of deep learning involving two neural networks pitted against each other. Autoregressive language models that use deep learning to produce human-like text.	GANs are at the cutting edge of AI, such that future applications are only slowly becoming evident. An autoregressive language model known as GPT-3 can produce impressive human-like text. However, despite appearances, the system does not understand the text that it outputs.[18]	This Person Does Not Exist[11] GPT-3 (Brown et al., 2020)

UNESCO, 2021

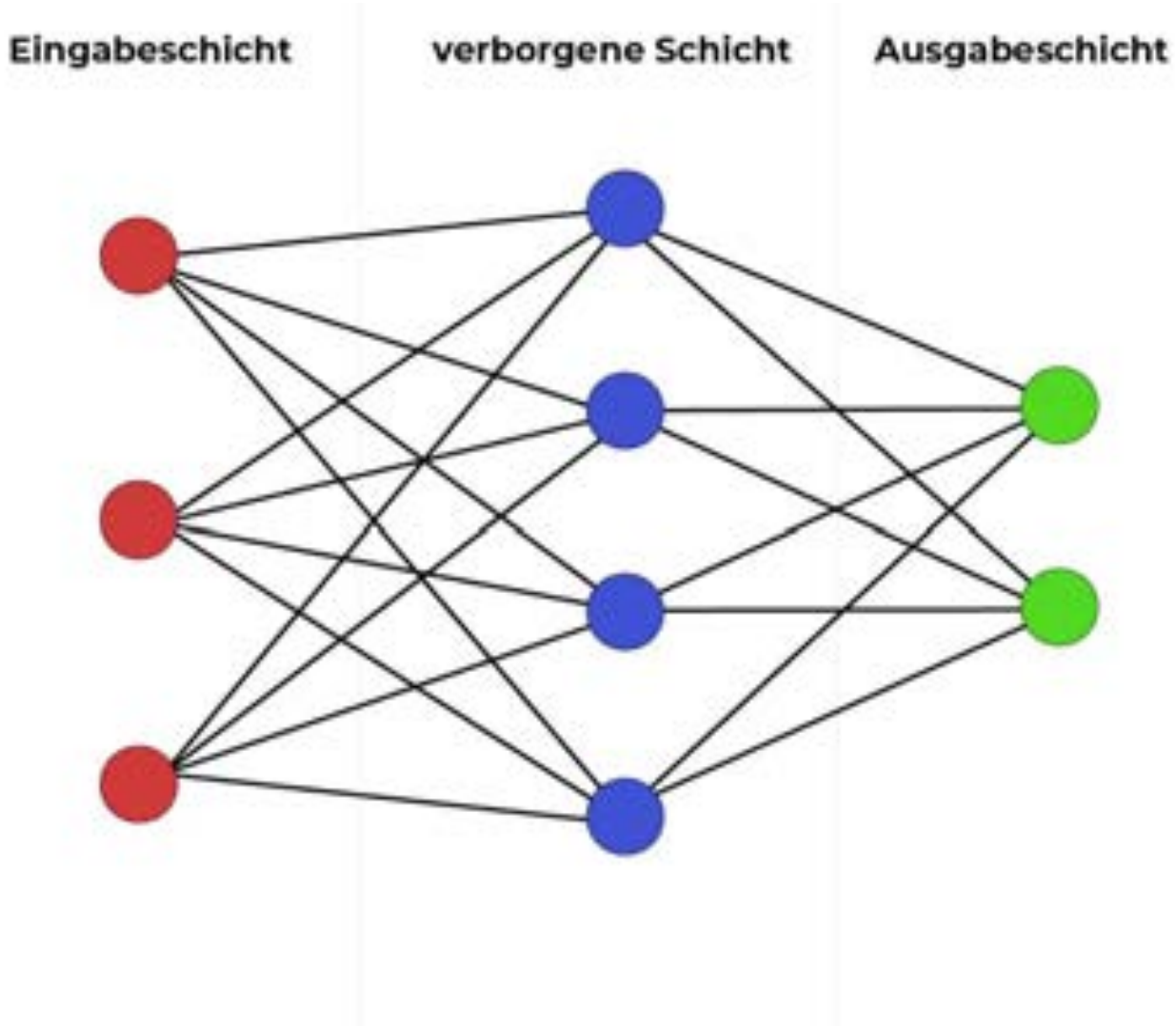
Machine Learning



Arten von Machine Learning Algorithmen.

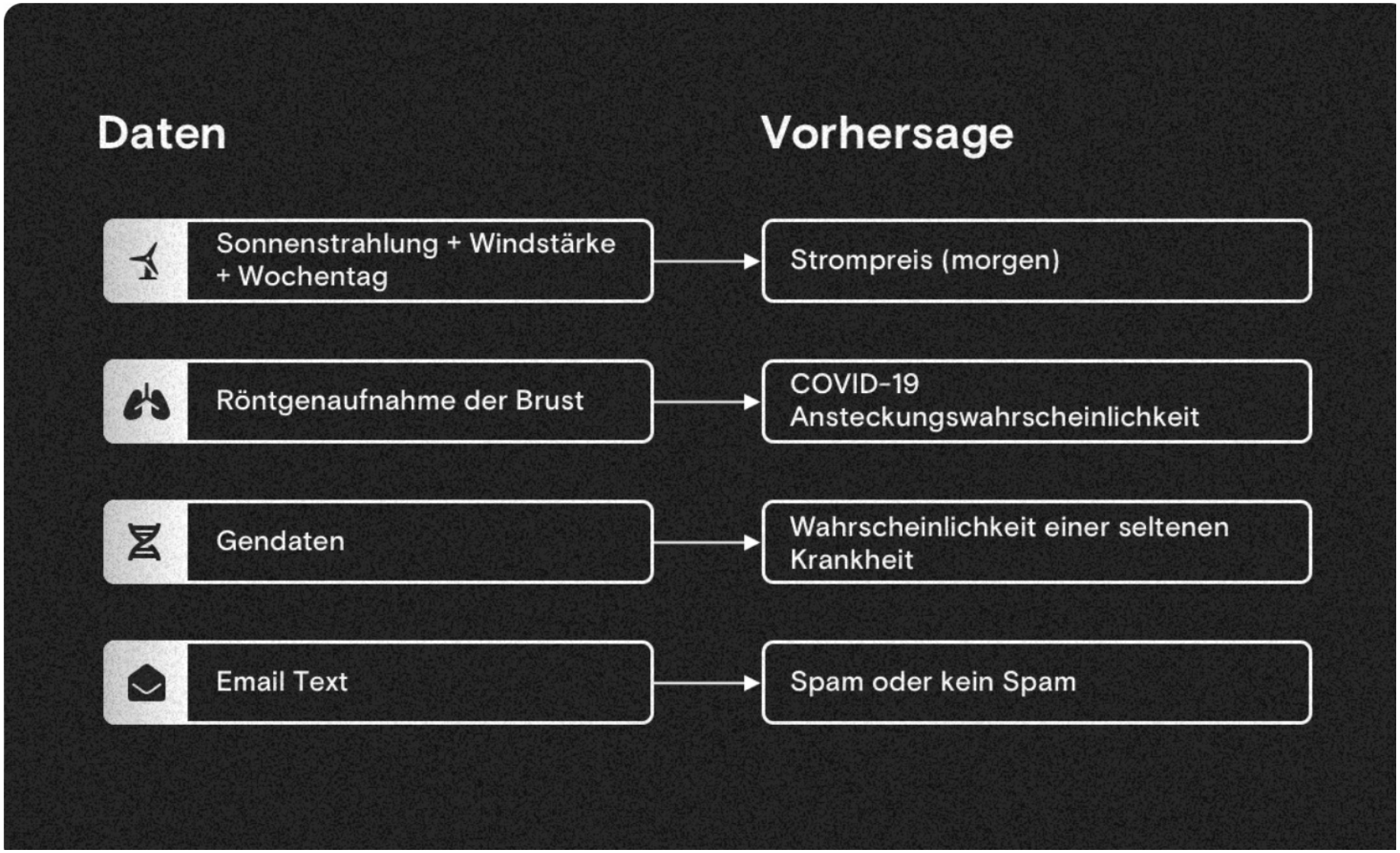
Datasolut/Laurenz Wuttke, 2022

Künstliche Neuronale Netze



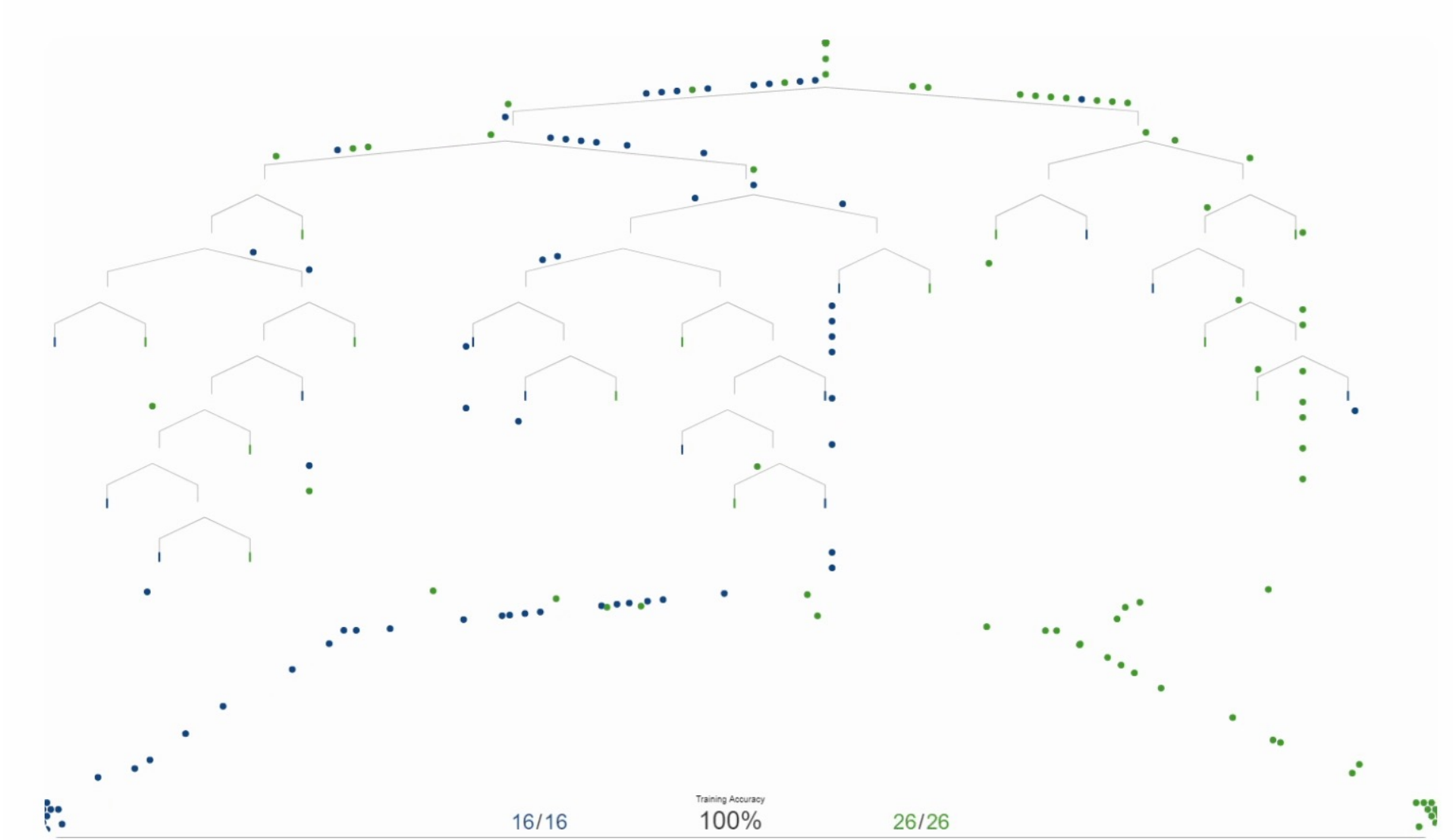
Datasolut/Laurenz Wuttke, 2022

Machine Learning Beispiel



Datarevenue/Markus Schmitt, 2022

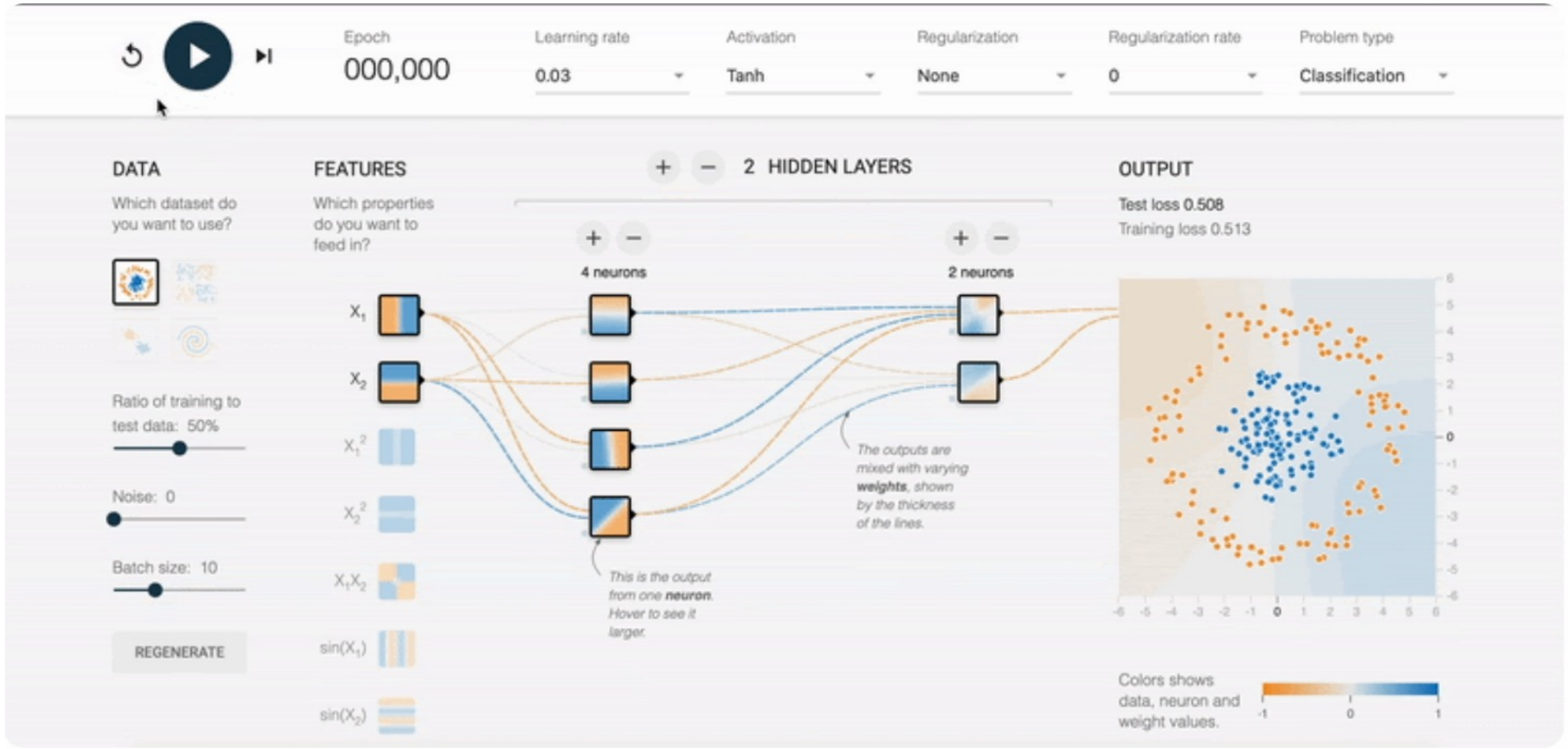
Machine Learning Beispiel



Datarevenue/Markus Schmitt, 2022

R2D3, 2017

Deep Learning Beispiel

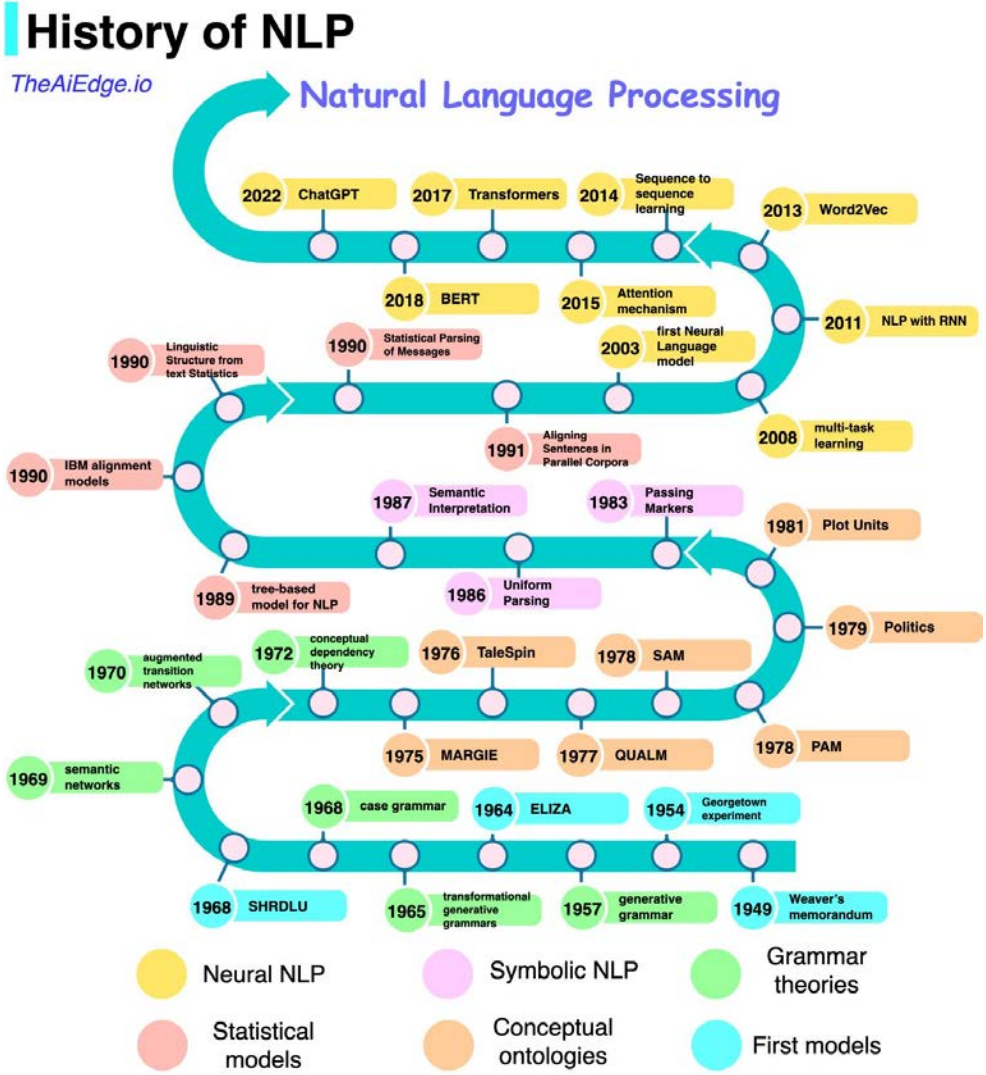


Ein neuronales Netz lernt eine Grenze zwischen blauen und orangen Punkten zu zeichnen.

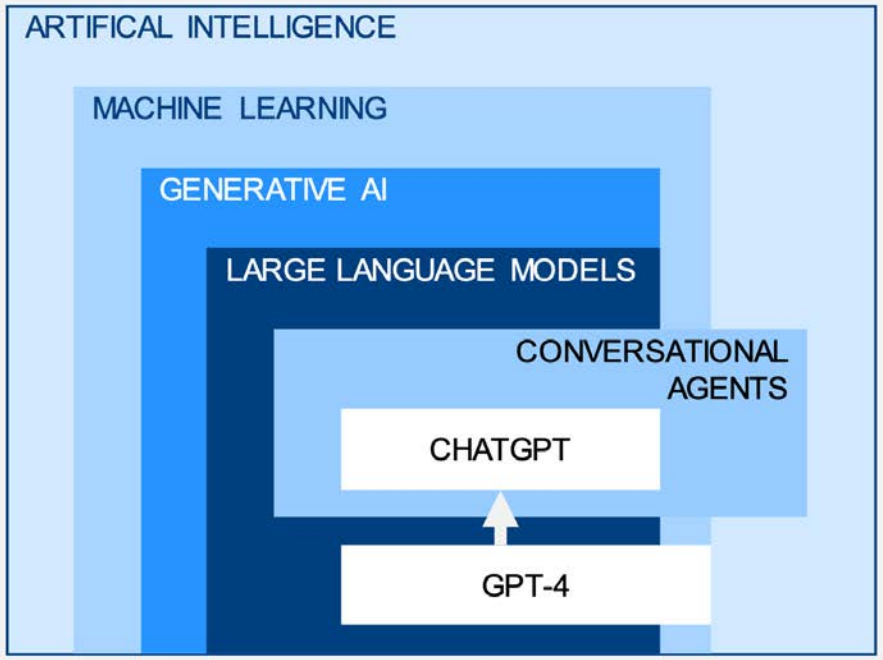
Datarevenue/Markus Schmitt, 2022

Tensorflow, 2022

Entwicklungskontext generativer KI

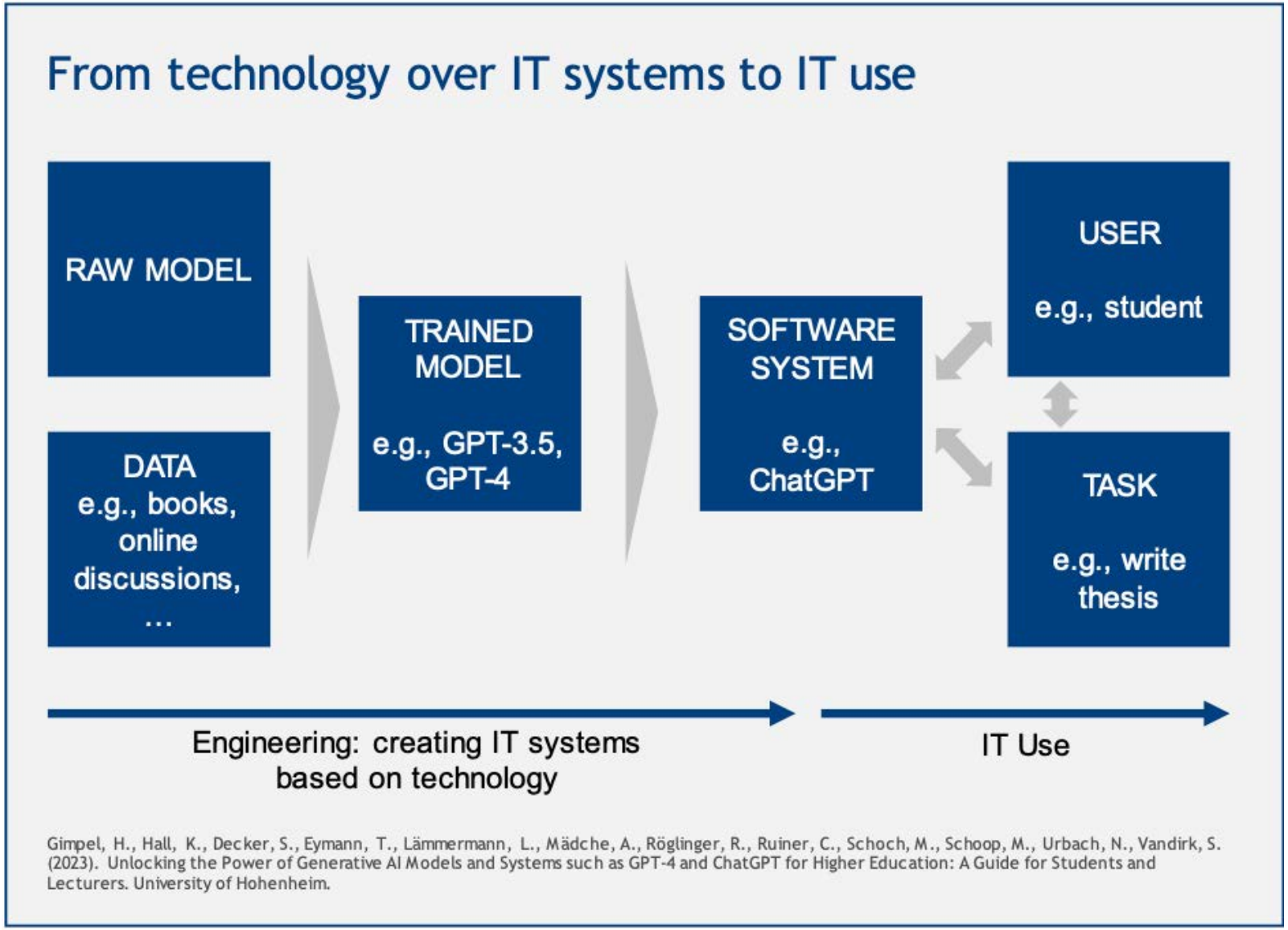


Key concepts related to Generative AI



Gimpel, H., Hall, K., Decker, S., Eymann, T., Lämmermann, L., Mädche, A., Röglinger, R., Ruiner, C., Schoch, M., Schoop, M., Urbach, N., Vandirk, S. (2023). Unlocking the Power of Generative AI Models and Systems such as GPT-4 and ChatGPT for Higher Education: A Guide for Students and Lecturers. University of Hohenheim.

Entwicklungskontext generativer KI



Gimpel, H., Hall, K., Decker, S., Eymann, T., Lämmermann, L., Mädche, A., Röglinger, R., Ruiner, C., Schoch, M., Schoop, M., Urbach, N., Vandirk, S. (2023). Unlocking the Power of Generative AI Models and Systems such as GPT-4 and ChatGPT for Higher Education: A Guide for Students and Lecturers. University of Hohenheim.

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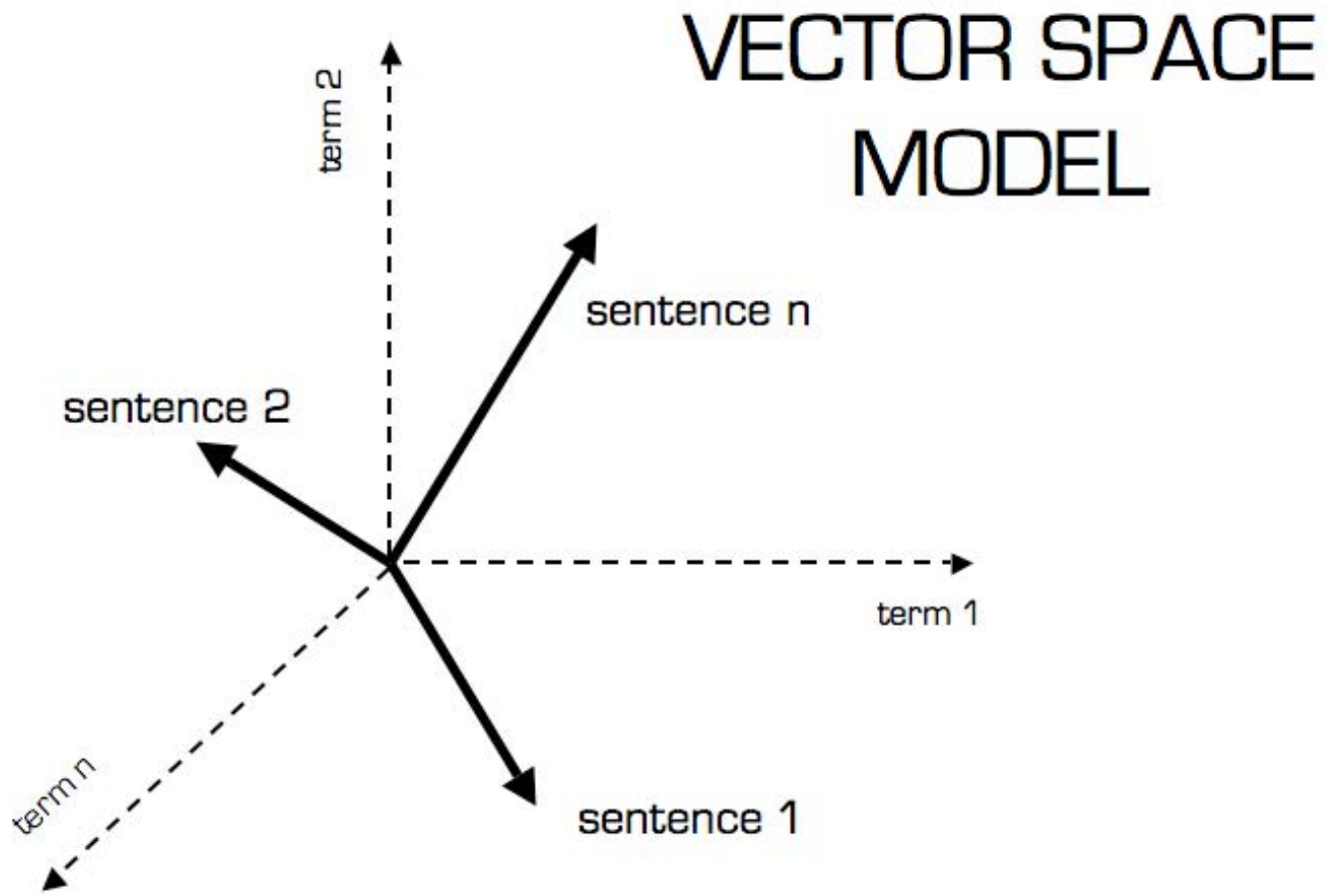
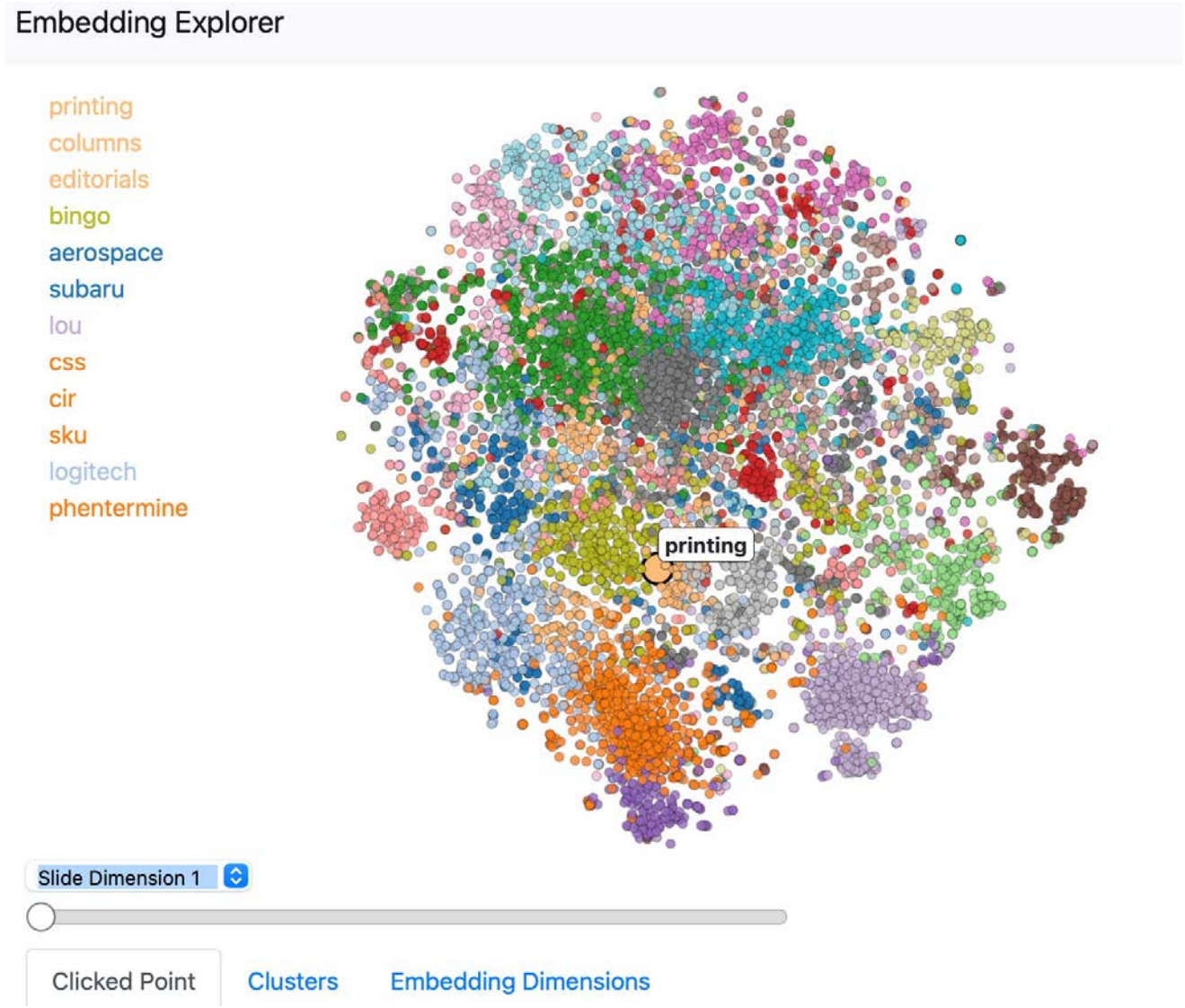


Entwicklungskontext generativer KI

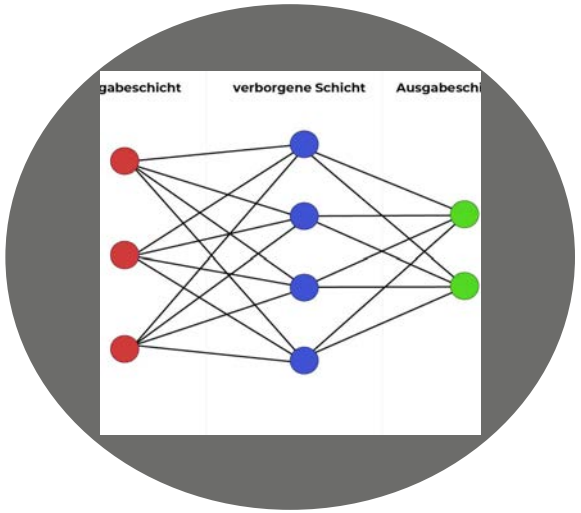


Edwin Chen, 2023

Large Language Models

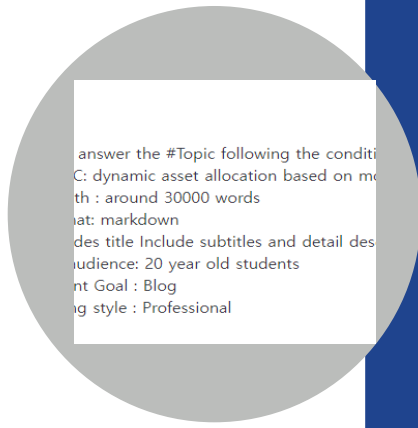
WÖRTER IN ZAHLEN

AUFMERKSAMKEIT



NEURONALES NETZWERK

FINE TUNING



PROMPTING

Wie funktioniert ChatGPT?

Wahrscheinlichkeiten/Probabilitäten

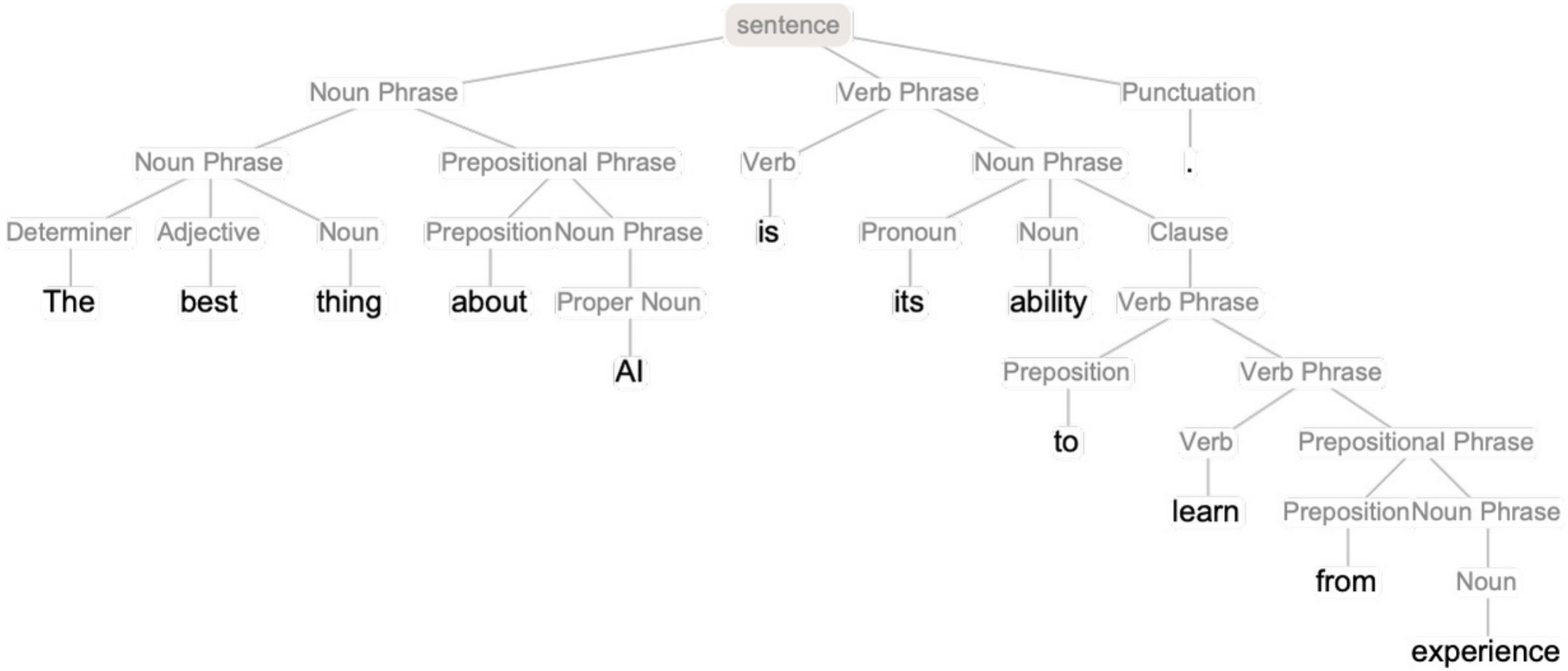
Andauernde Frage: Angesichts des vorhandenen Texts, was wäre die sinnvollste Ergänzung?

Das Beste an KI ist die Fähigkeit, zu

lernen	4,5 %
vorherzusagen	3,5 %
machen	3,2 %
verstehen	3,1 %
tun	2,9 %

Stephen Wolfram, 2023

Wie funktioniert ChatGPT?



Stephen Wolfram, 2023

02

KI in der Bildung

Stand der Forschung vor ChatGPT

KI in der Bildung: Lange Tradition

IAIED

1.1.1997

Volume 1 (1989)

1 (4)

Theoretical foundations for intelligent tutoring systems
John A. Self

› Read More

Volumes

32 (2022)
31 (2021)
30 (2020)
29 (2019)
28 (2018)
27 (2017)
26 (2016)
25 (2015)
24 (2014)

KI in der Bildung: Profilanalyse und Vorhersage

- Zugang zu und Taktung von Kursen
- Vermeidung v. Abbruch/Verbesserung von Erfolg(schancen)
- Lernermodellierung und Einfluss auf Abschlussergebnisse

Zawacki-Richter, Marín, Bond & Gouverneur, 2019

KI in der Bildung: Intelligente Tutorielle Systeme

- Adaptation von Lerninhalten
- Performanceanalyse und automatisiertes Feedback
- Zusammenstellung von Lerninhalten
- Unterstützung von Zusammenarbeit
- Unterstützung von Lehrenden

Zawacki-Richter, Marín, Bond & Gouverneur, 2019

KI in der Bildung: Prüfungs- und Testsysteme

- Automatisierte Benotung
- Feedback
- Sicherung von Verständnis, Aktivierung und Integrität
- Lehrevaluation

Zawacki-Richter, Marín, Bond & Gouverneur, 2019

KI in der Bildung: Adaptive Systeme und Personalisierung

- Einsatz in der Lehre
- Empfehlung personalisierter Inhalte
- Unterstützung von Lehrenden und Designprozessen
- Studentische Daten zur Orientierung und Hilfestellung
- Darstellung von Wissen mit Wissenslandkarten

Zawacki-Richter, Marín, Bond & Gouverneur, 2019

KI in der Bildung: Zusammenfassung

- Sehr wenige Implementations- und Wirkungsstudien
- Kaum Reflexion zu ethischen und pädagogischen Implikationen
- Kaum Einbeziehung von Pädagog:innen

Zawacki-Richter, Marín, Bond & Gouverneur, 2019

KI in der Bildung (Vor GAI)

Theorie -> Praxis

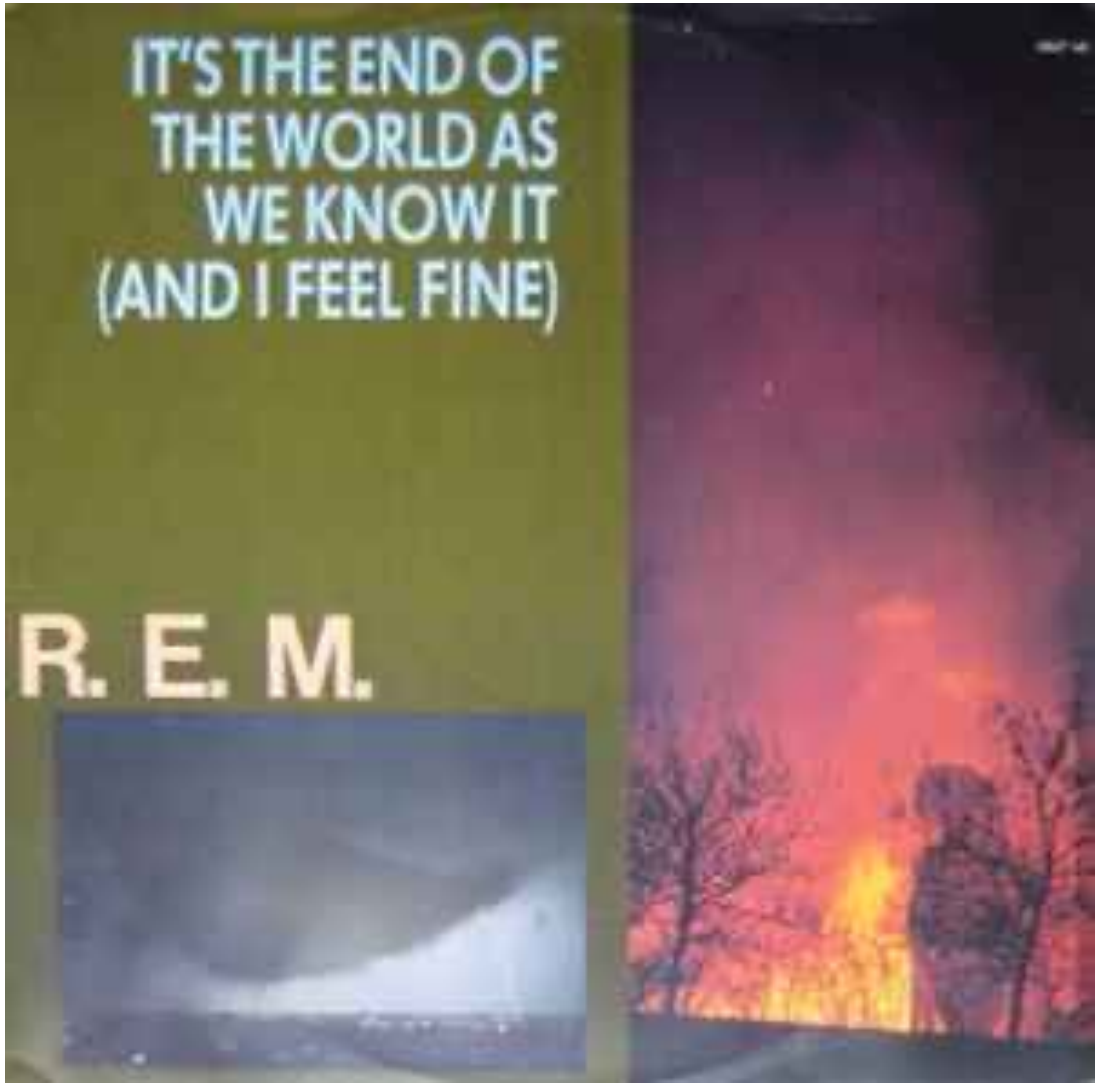
Generative KI eröffnet ein neues Zeitalter

- Erstmalig breite Verfügbarkeit
- Scheinbar intelligente Texte/Produkte
- Verschiedene Medien
- Experimentation einfach möglich
- Entwicklung eigener KI-Angebote

KI in der Bildung (Nach GAI)

Praxis -> Theorie

Neues Umgehen mit digitaler Technologie



Das Ende der Objektifizierung von Bildungstechnologie

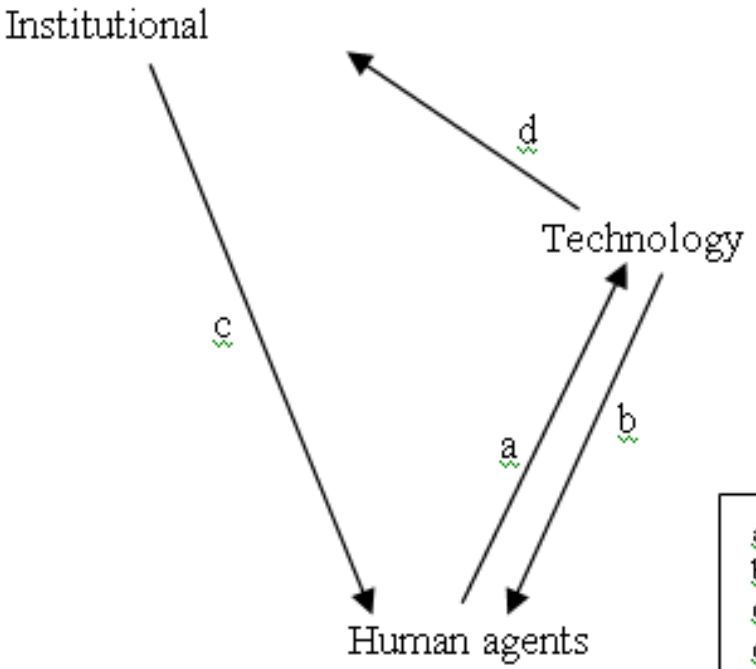
Gur & Wiley, 2007

Technologischer Determinismus (Chandler, 1995)

- Reduktionismus
- Reifikation: homogene Merkmale
- Technologische Autonomie
- Neutralität von Technologie

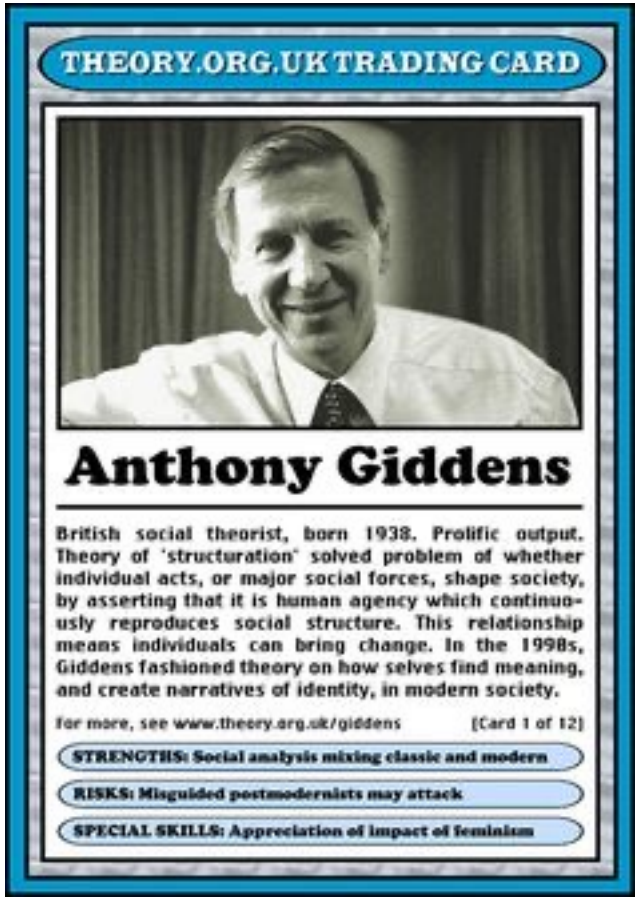
Technology as a “discrete force with a discernible direction and influence” (Pannabecker, 1991)

Alternative Konzepte (strukturierungstheoretisch)



a	technology as a product of human agency
b	technology as a medium of human action
c	institutional conditions of interaction with technology
d	institutional consequences of interaction with technology

Figure 2: Structurational model of technology (Orlikowoski, 1992)



Adaptive structuration theory

It´s goal is to confront „structuring´s central paradox: identical technologies can occasion similar dynamics and yet lead to different structural outcomes" (Barley 1986)

„There is no doubt that technology properties and contextual contingencies can play critical roles in the outcomes of advanced information technology use. The difficulty is that there are no clearcut patterns indicating that some technology properties are contingencies consistently lead to either positive or negative outcomes" (DeSanctis & Poole 1994, S. 124).

Das Ende von Medienvergleichsstudien

To prove or improve, that is the question: the resurgence of comparative, confounded research between 2010 and 2019

Peter C. Honebein & Charles M. Reigeluth

Educational Technology Research and Development **69**, 465–496 (2021) | Cite this article

1022 Accesses | **12** Citations | **8** Altmetric | Metrics

Published: 26 July 2020

The research we have is not the research we need

Thomas C. Reeves & Lin Lin

Educational Technology Research and Development **68**, 1991–2001 (2020) | Cite this article

7794 Accesses | **50** Citations | **29** Altmetric | Metrics

Abstract

The special issue "A Synthesis of Systematic Review Research on Emerging Learning Environments and Technologies" edited by Drs. Florence Martin, Vanessa Dennen, and Curtis Bonk has assembled a noteworthy collection of systematic review articles, each focusing on a different aspect of emerging learning technologies. In this conclusion, we focus on these evidence-based reviews and their practical implications for practitioners as well as future researchers. While recognizing the merits of these reviews, we conclude our analysis by encouraging readers to consider conducting educational design research to address serious problems related to teaching, learning, and performance, collaborating more closely with teachers, administrators, and other practitioners in tackling these problems, and always striving to make a difference in the lives of learners around the world.

ELSEVIER

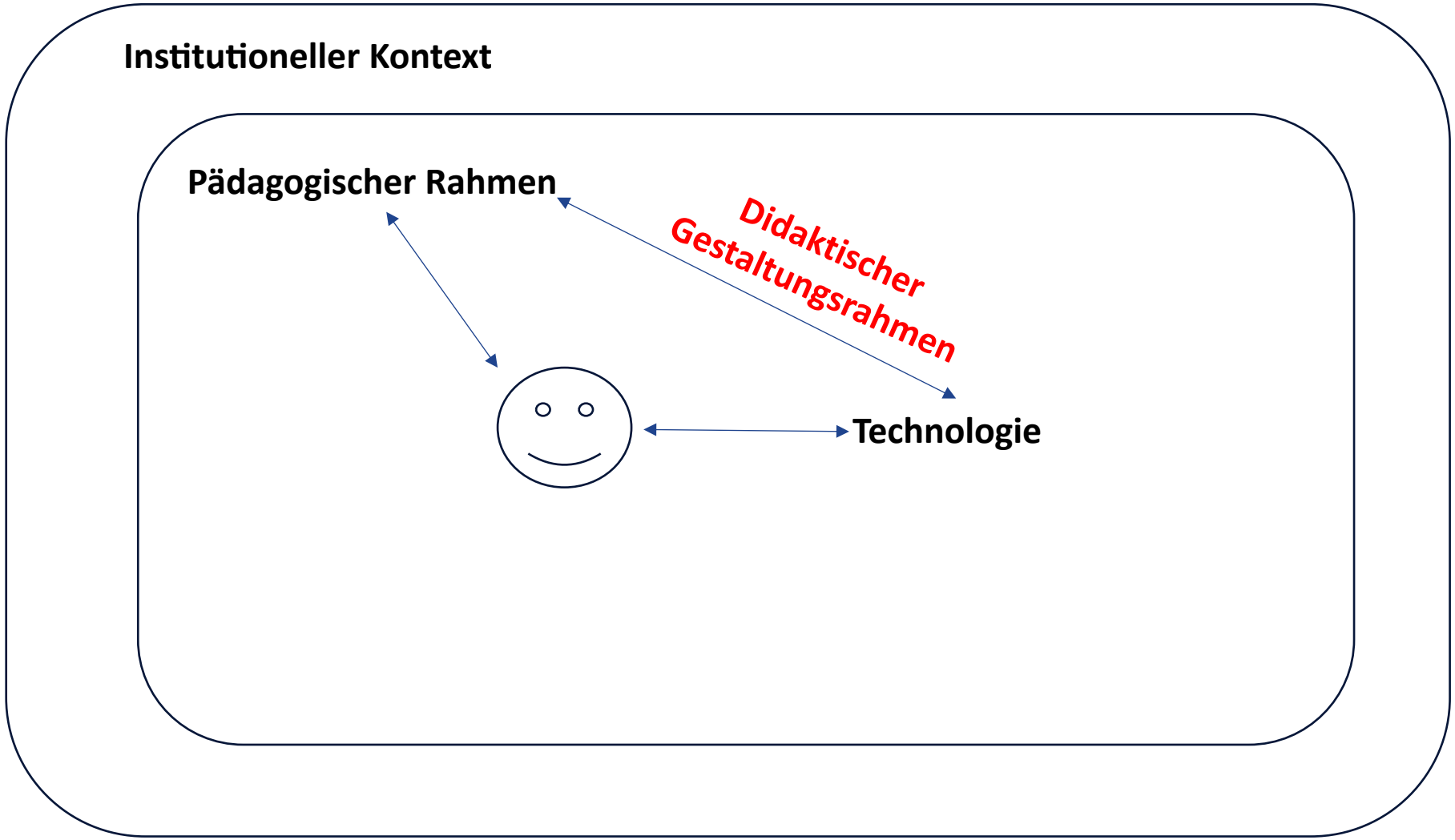
Computers & Education

Volume 195, April 2023, 104711

Media comparison studies dominate comparative research on augmented reality in education ☆

Josef Buchner [a], Michael Kerres [b]

Strukturierungstheoretisches Paradigma



Embrace

change/chaos

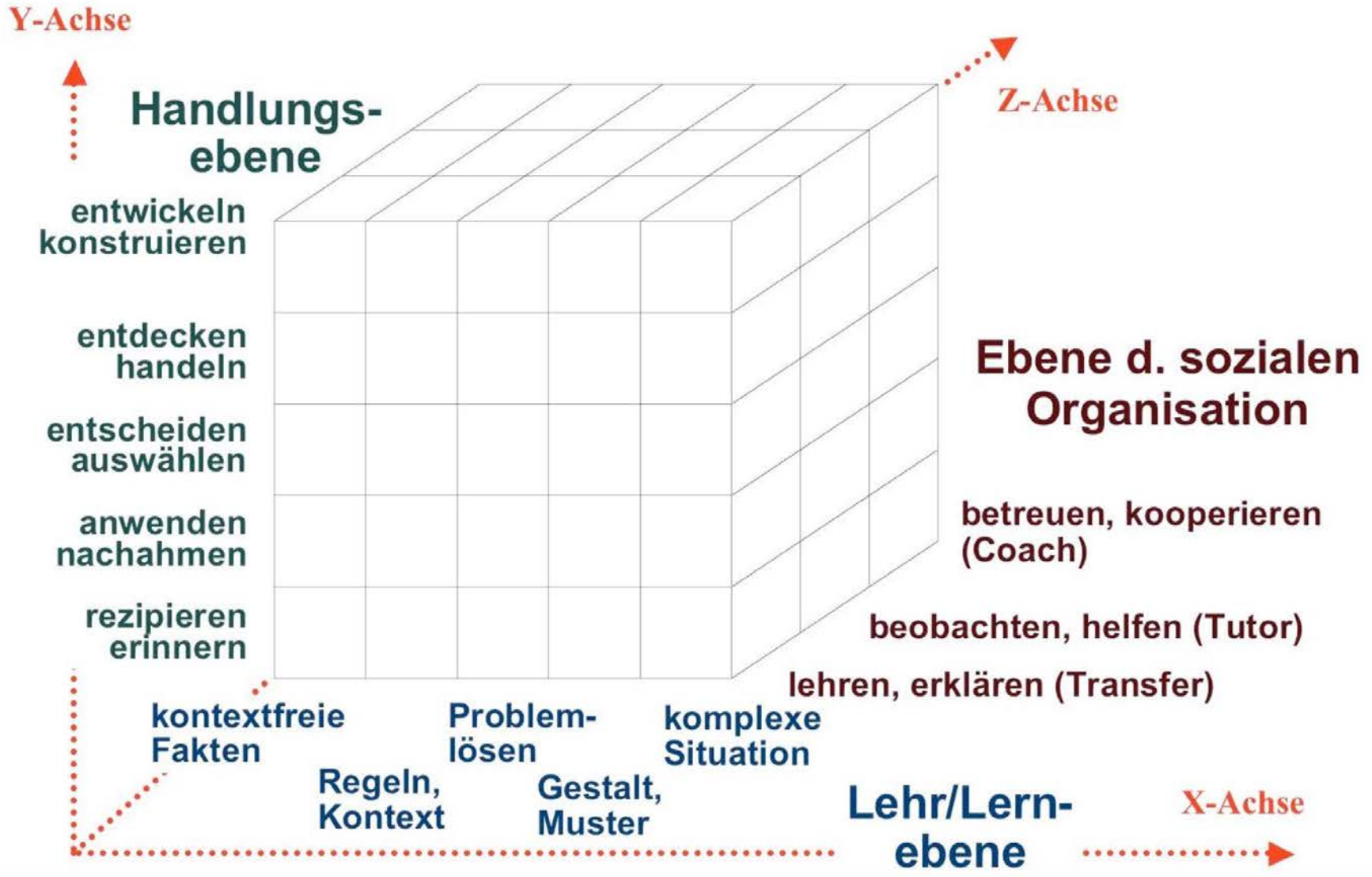
Pädagogische Hochschule HEIDELBERG University of Education

03

Didaktisches Feld

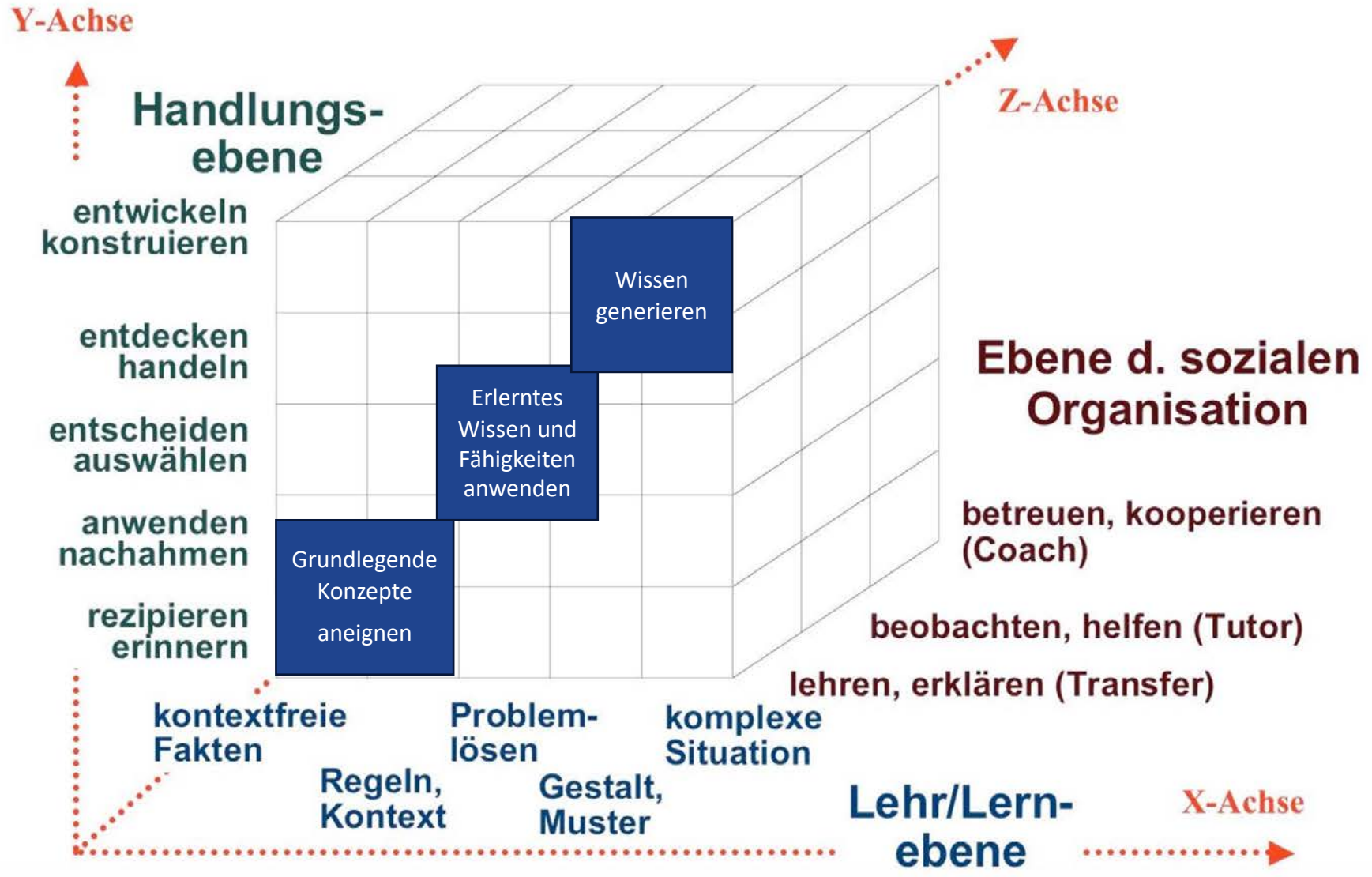
… der Hochschullehre

Didaktischer Raum der Hochschuldidaktik



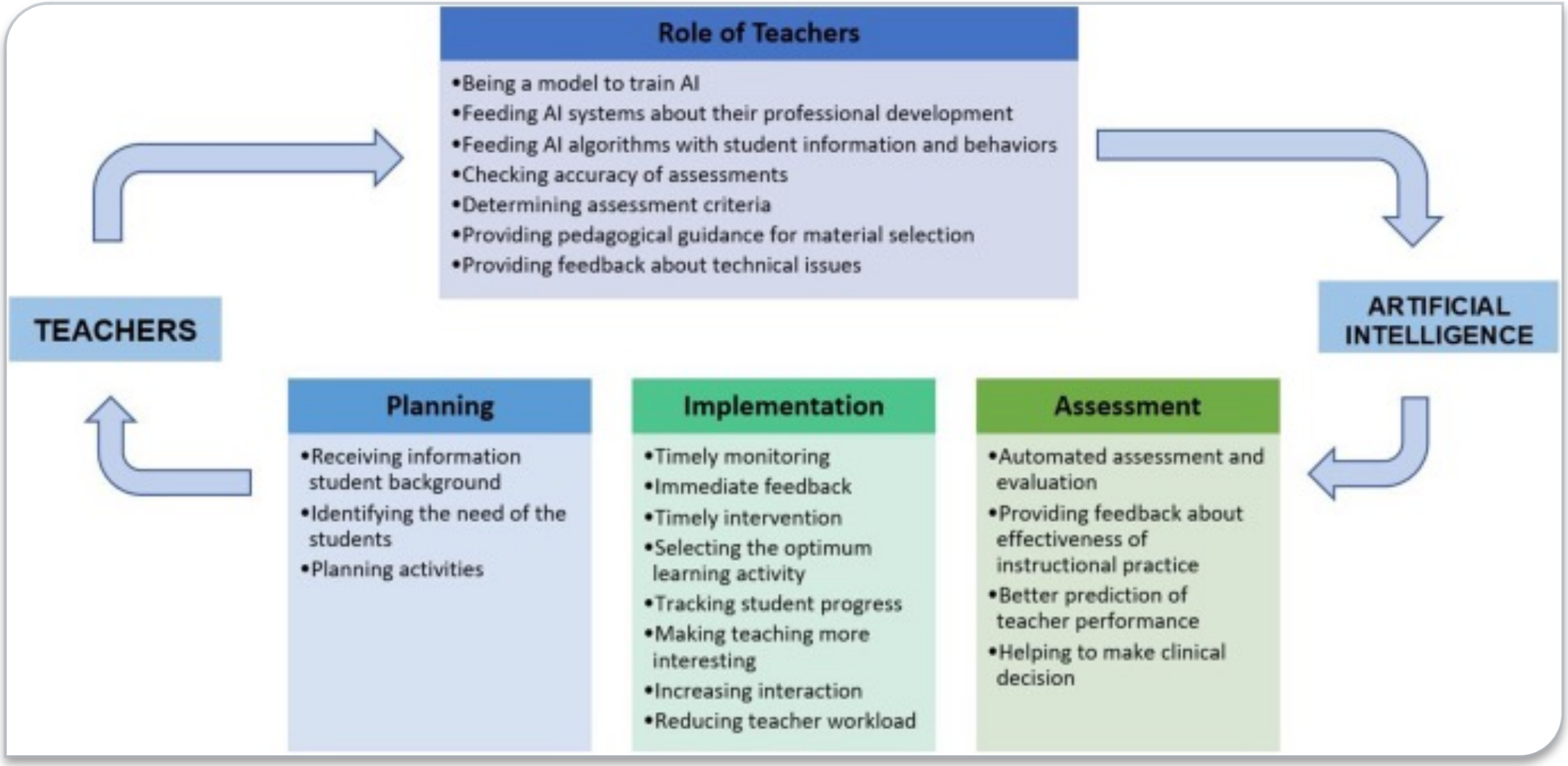
Baumgartner, 2003

Didaktischer Raum der Hochschuldidaktik



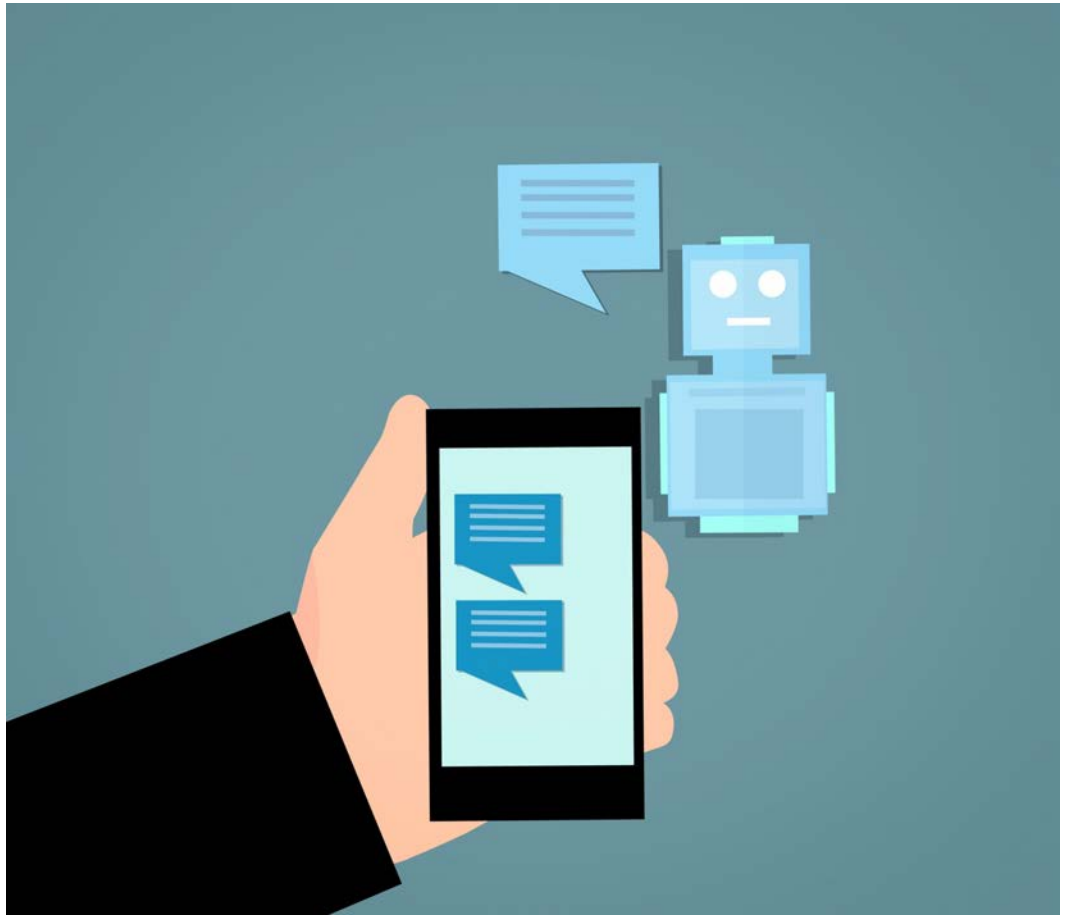
Baumgartner, 2003

Didaktische Implikationen



Celik, Dindar, Mukkonen & Järvelä, 2022

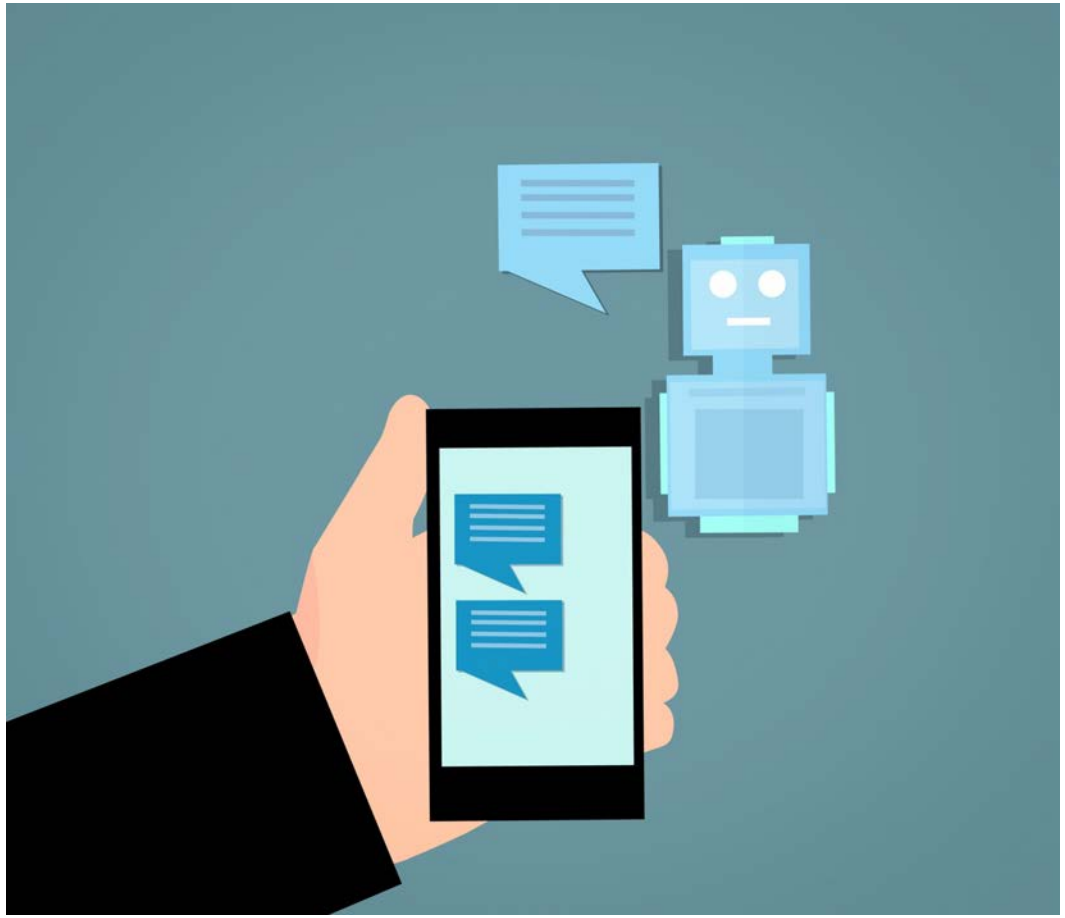
Grundlegende Konzepte aneignen



Lernen	Lehren
Fachspezifische KI-Tutoren zur Aneignung von Fachwissen	Generierung von Wissensfragen und passendem Feedback
Zusammenhänge zwischen Konzepten über kurze Prompts verifizieren/ eigene Interpretationen testen	Generierung von Erklärvideos über Faktenwissen und prozedurales Wissen
Alternative Argumentationen oder Denkweisen explorieren	
Sprachlichen Ausdruck verbessern	

Kanseci et al., 2023; Sharples, 2023

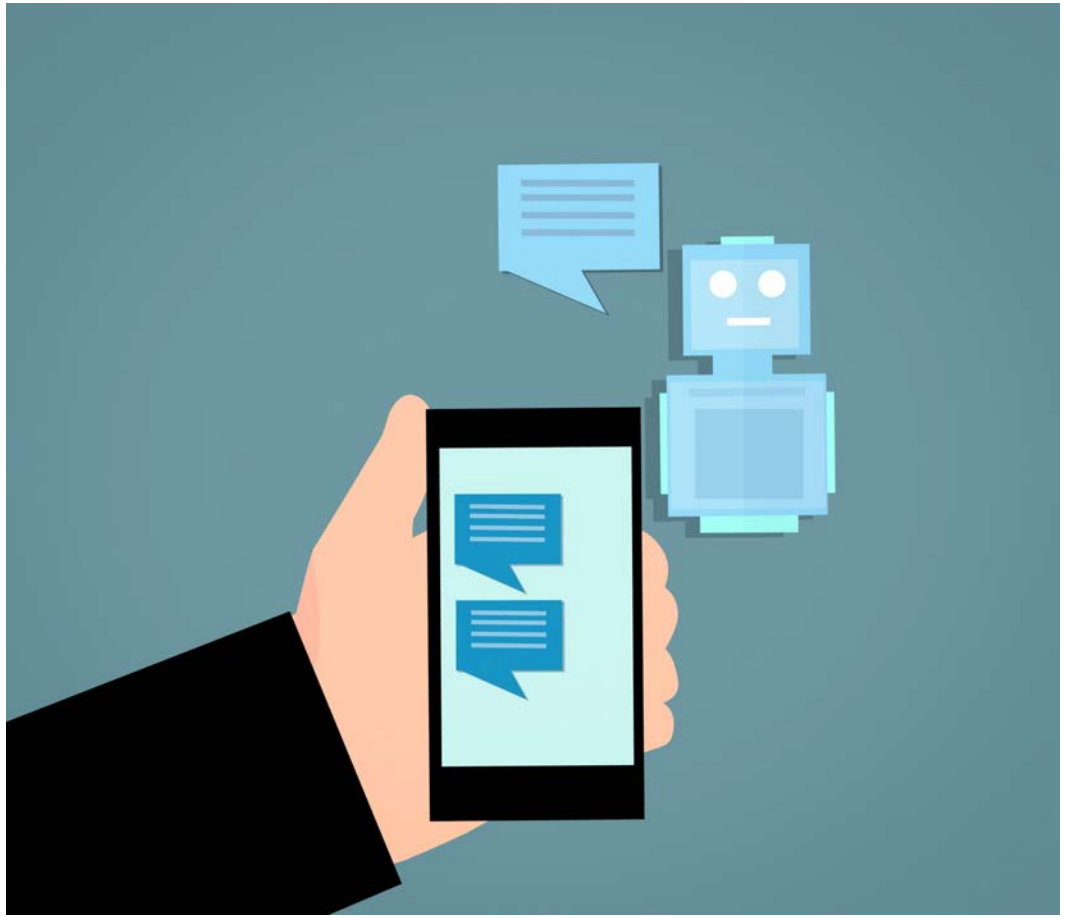
Erlerntes Wissen und Fähigkeiten anwenden



Lernen	Lehren
Handlungspläne und Vorgehensweisen entwickeln	Fälle und (halboffene) Problemstellungen generieren
Probleme in Teilprobleme zerlegen	Anwendungsbeispiele generieren
Sokratischer Dialogpartner	
Handlungsstrategien eruieren	

Kanseci et al., 2023; Sharples, 2023

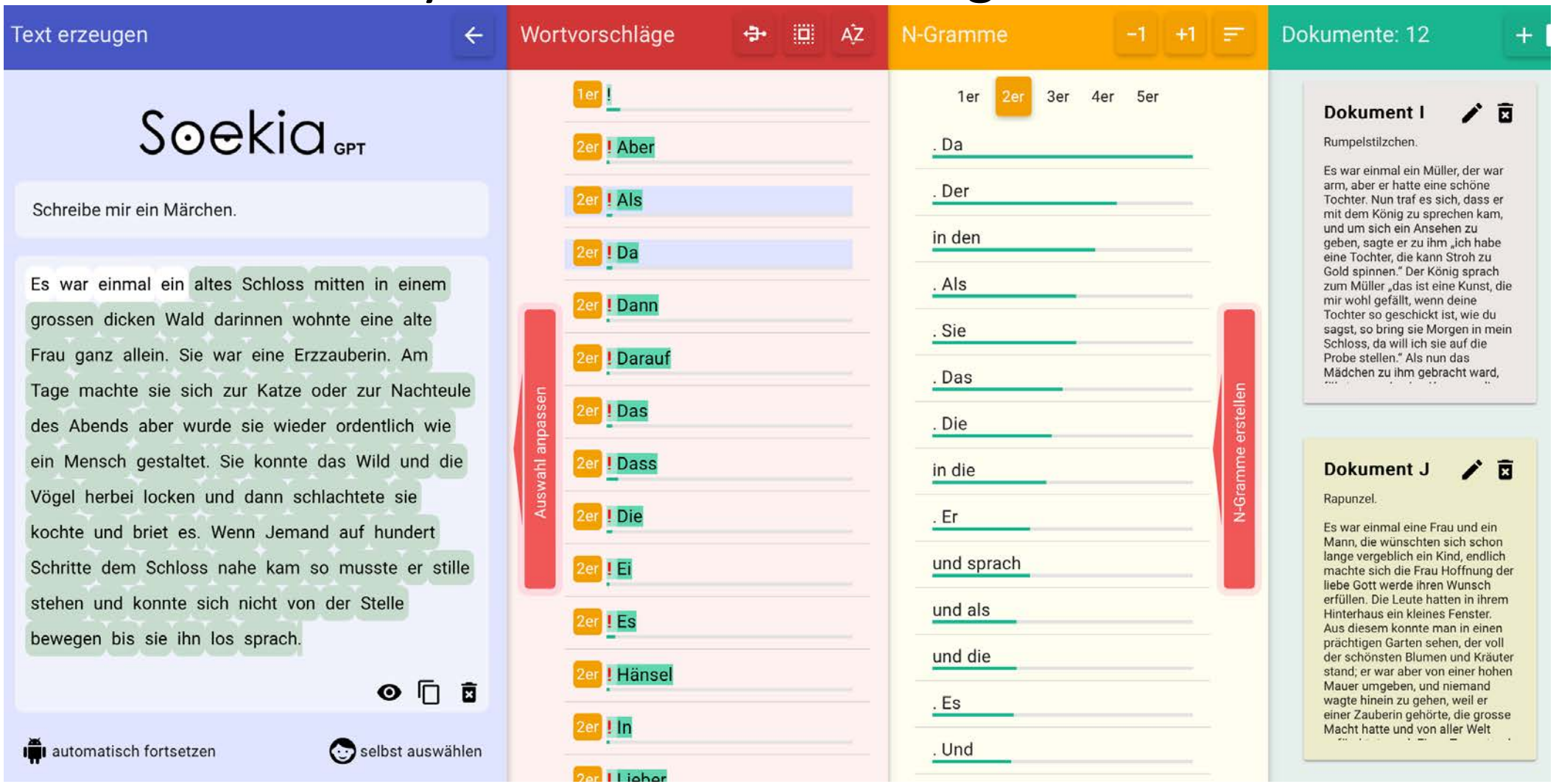
Wissen generieren



Lernen	Lehren
KI als Co-Designer in Gestaltungsprozessen	Komplexe, offene Probleme generieren
Kritisches Denken üben	Forschungsfragen identifizieren
KI generiert Daten, die analysiert werden	

Kanseci et al., 2023; Sharples, 2023

LLMs & KI entmythifizieren: Technologisches Wissen



https://www.soekia.ch/GPT/

Didaktische Implikationen: Die Macht des Prompting

CRAFT Power Prompts for Educators:

C CONTEXT: Be specific in telling the AI any additional details or information to help it understand what you need. Context is everything!
EX. “My students read below grade level” “This is an advanced level group who needs to be challenged” “include opportunities for collaboration in small groups” “Align the lesson with Bloom’s Taxonomy”. etc

R ROLE: Assign the AI a role and audience so it will provide a better answer. Think, “Who do I wish I had access to to help me with this task?”
EX. “You are an exceptional algebra teacher”, “You are a professional chemist”, “You are a excellent math tutor”, “You are Harriett Tubman”, “You are an experienced behaviorist skilled with managing disruptive classroom behaviors”

A AUDIENCE: Providing the tartget audience helps the AI adjust the level and tone to that particular person or group.
Ex “Highschool students”, “5th grade math students”, “Middle school ESL students”,“school board members”, “perspective employer”, “11th grader with severe dyslexia”, “angry parent”, etc

F FORMAT: Text models can produce more than just sentences. Ask for the format you want. It may also help to provide an exemplar. Ex. “write each analogy in this format ‘a is to b as is to y’”
Ex. Bulleted list, paragraphs, 500 words or less, Mark down, poem, haiku, limerick, rhyme, rap song, table, HTML, Python, C++, Google sheets formula, etc etc.

T TASK (Mandatory) & TONE (optional): Always provide a task you want the AI to do in the form of a verb/action word.
Ex. Evaluate, Generate, Edit, Revise, Summarize, Explain, Brainstorm, Draft email, Analyze, Reword,etc
You may also specify a tone (Ex. Professional, friendly, caring, concerned, concise, firm, etc)

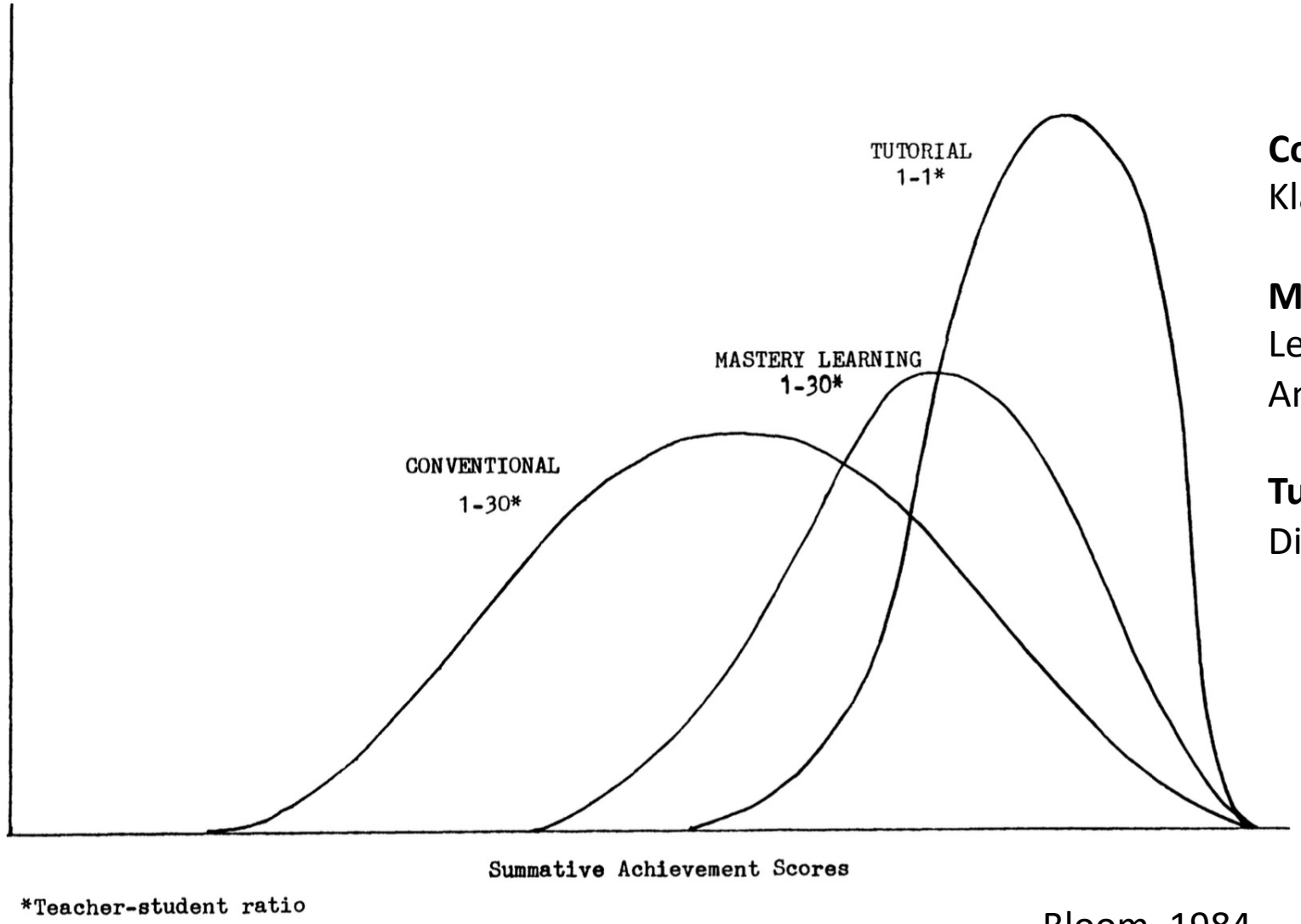
Use AI Ethically EVERY Time

North Carolina Department of PUBLIC INSTRUCTION

The CRAFT framework was created by me, Vera Cubero

Cubero, 2023

Didaktische Implikationen: Das 2-Sigma Problem



Conventional: 30 Schüler:innen pro Klasse & frontal

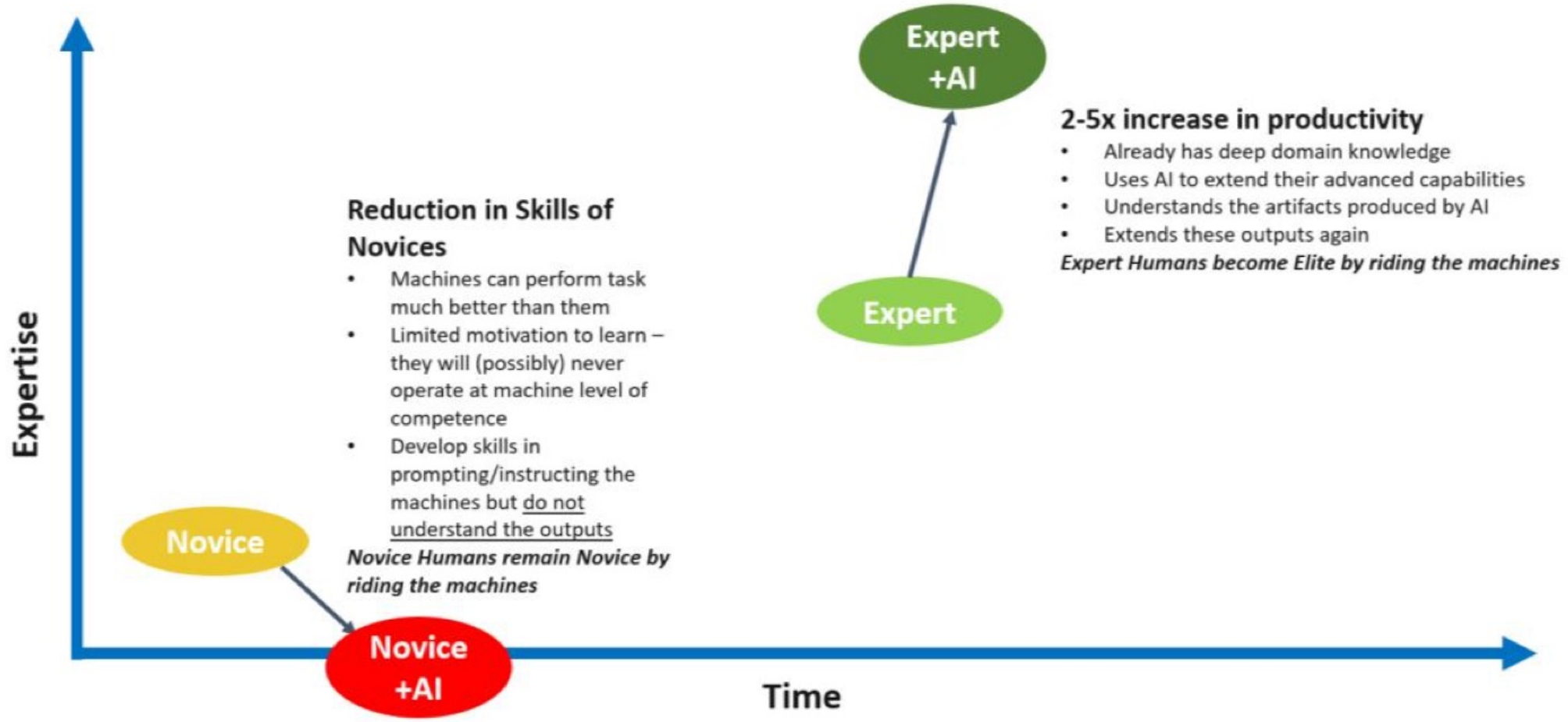
Mastery learning: 30 Schüler:innen pro Lehrenden plus formatives Feedback und Anweisungen zu Verbesserungen

Tutorial: Tutor plus 1 – 3 Schüler:innen. Direktes Feedback und Scaffolding.

Bloom, 1984

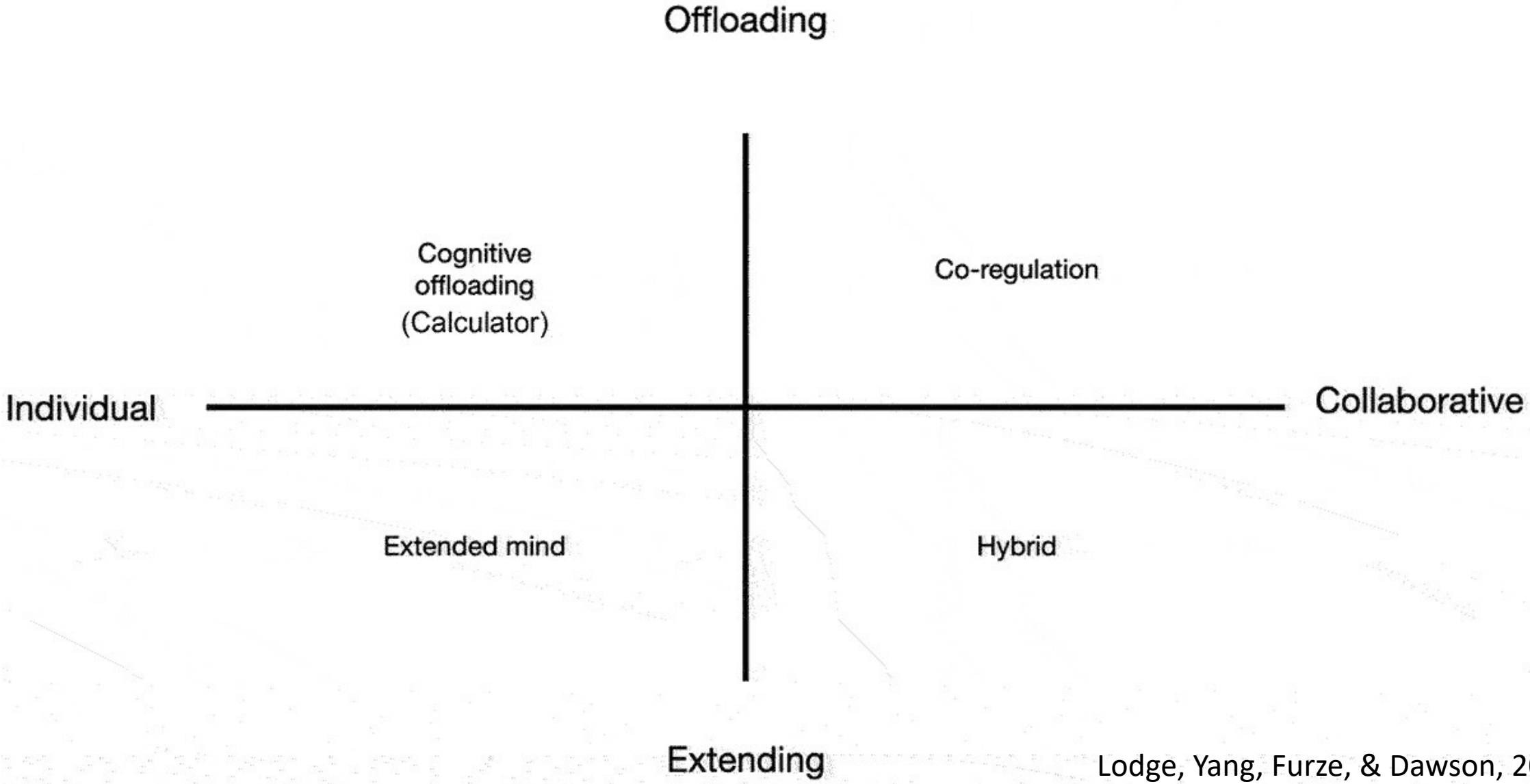
Didaktische Implikationen: Anfänger vs. Expert:innen

Figure 7: Experts vs Novices in the World of AI



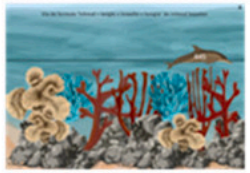
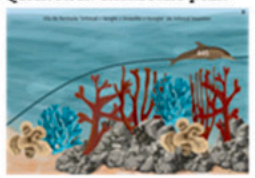
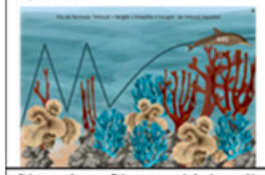
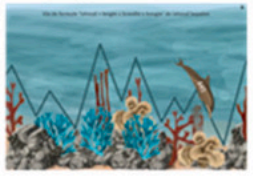
Hamilton, William & Hattie, 2023

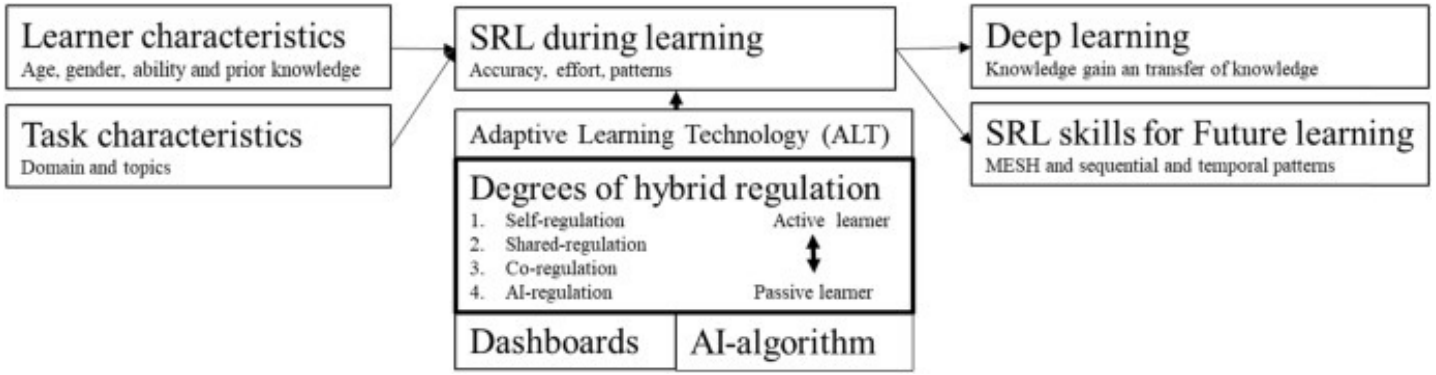
Mensch/KI-Arbeitsteilung



Lodge, Yang, Furze, & Dawson, 2023

Geteilte Regulation: HHAIR-Modell und Beispiel

Personalized dashboards	Planning	Monitoring
High swimmer: Immediate drop 	You already know this skill. → Please practice a different skill.	Your accuracy is high, well done!
Quick riser: Immediate peak 	You have learned this skill quickly after the teacher explained it. → You can practice until you have reached proficiency (green dolphin) and then continue on the next skill.	Your accuracy is high, well done!
Riser in two stages: Double Spikes 	You have learned this skill in two stages during guided instruction and class wide practice. → Please practice until you have reached proficiency.	→ Please monitor your accuracy during practice. → Do you feel that you can put in a little more effort? Try to become a quick riser!
Slow riser: Close multiple spikes 	You are learning this skill somewhat slowly. → Please continue to practice in adaptive mode until you have reached proficiency.	→ Please monitor your accuracy during practicing. → Do you feel that you can put in a little more effort? Try to become a riser in two stages!
Riser and descender: Separate multiple spikes 	You are learning this skill quite slowly. → Please continue to practice in adaptive mode → If you cannot master this skill please notify your teacher	→ Please monitor your accuracy during practicing. → Do you feel that you can put in a little more effort? Try to become a slow riser!



Molenaar, 2023

Didaktische Implikationen: Geteilte Regulation (SRL)

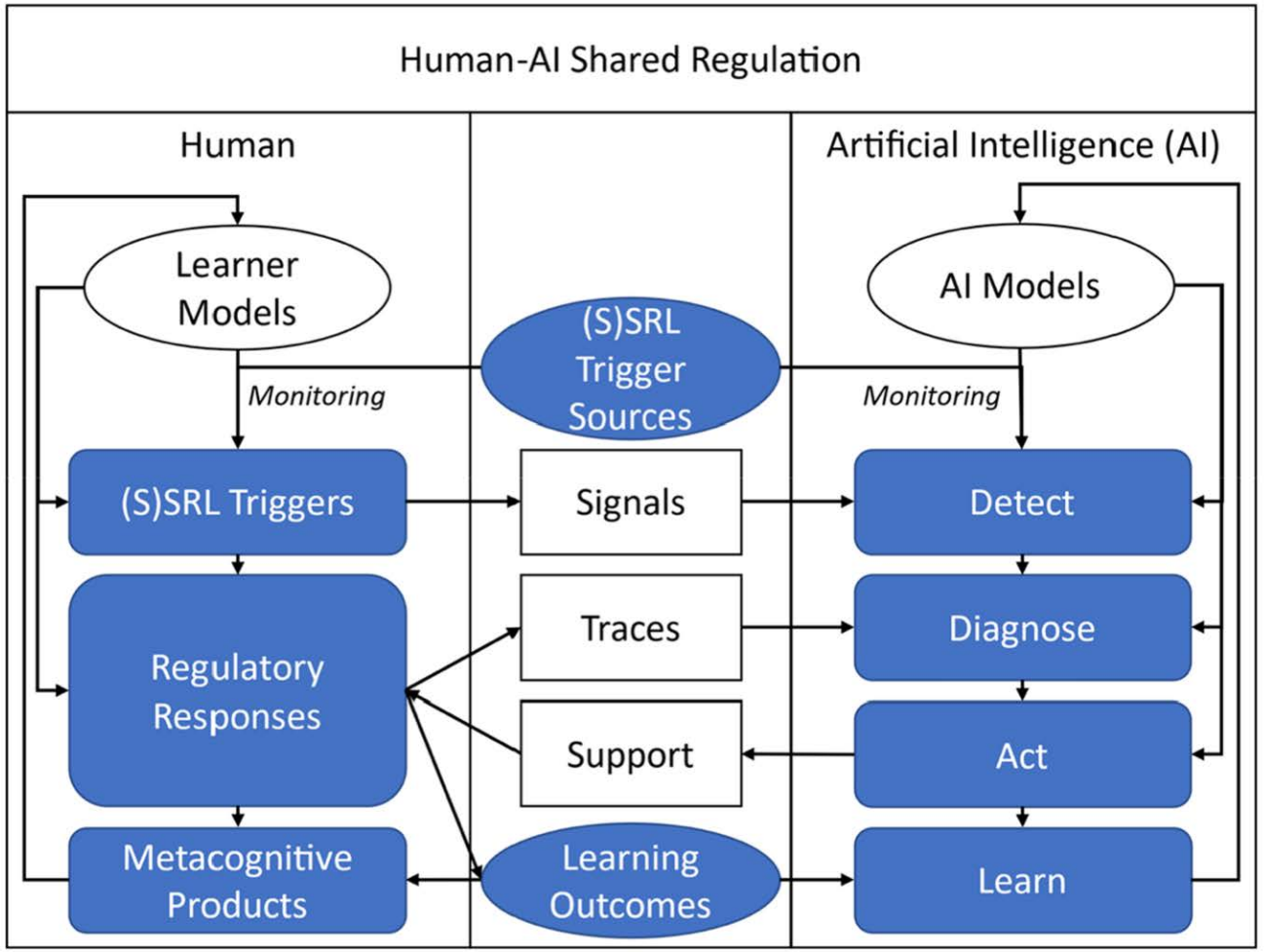


FIGURE 2 Human-AI shared regulation in learning (HASRL) model.

Järvelä, Nguyen, & Hadwin, 2023

Didaktische Implikationen: UNESCO framework for teachers

Aspects	Progression		
	Understand	Apply	Create
Human-centred Mindset	Critical Views of AI	Contextual adoption strategies	Steering long-term impact
Ethics of AI	Human agency	Human-centred use	AI society skills
Foundation AI knowledge	"Algorithm and data literacy" or AI literacy	Use AI analytics	Coding and data models
AI skills	Test and use	Infusing uses	Integrating AI tools
AI pedagogy	AI for teaching	AI to deepen learning	AI for co-creation
Professional development	AI to assist administrative tasks	AI for curriculum design and delivery	AI empowering teaches

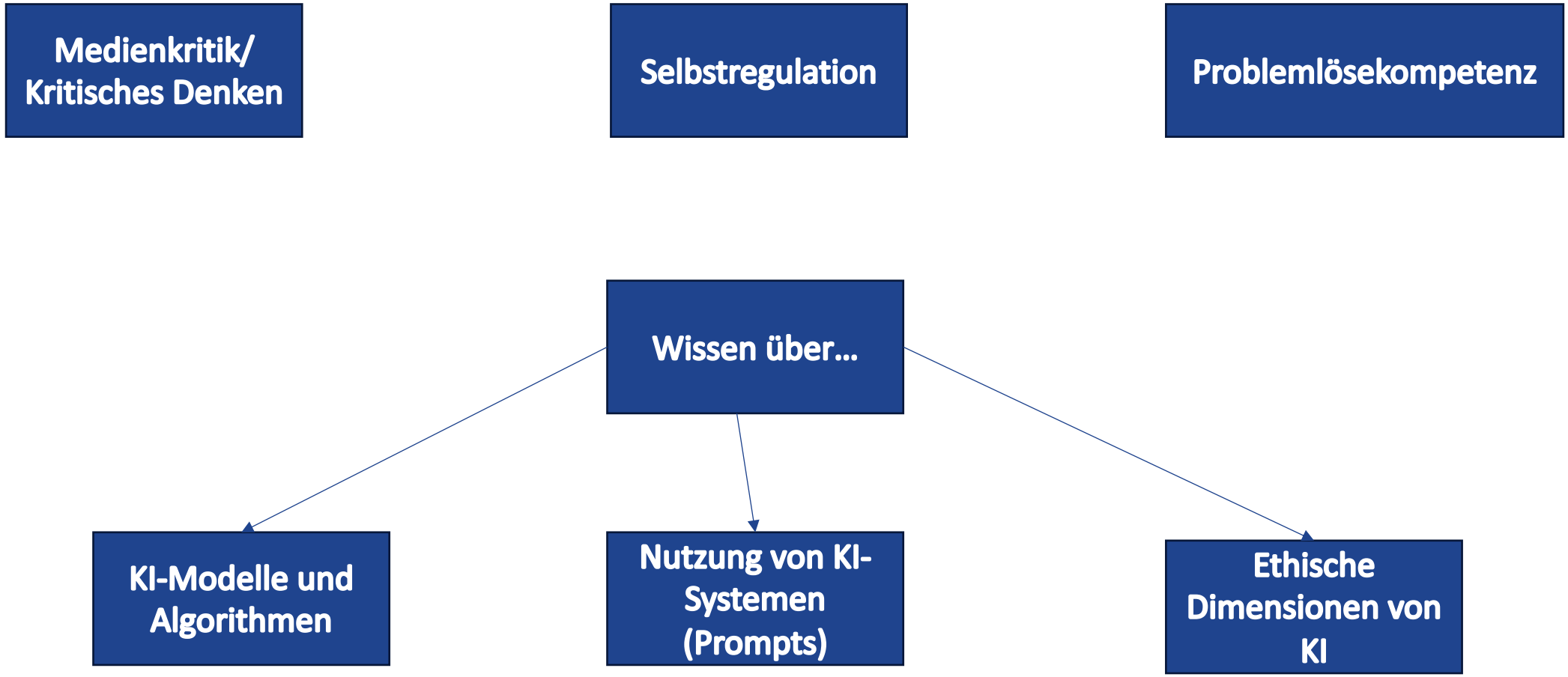
UNESCO, 2023

Didaktische Implikationen: UNESCO framework for learners

Aspects	Progression		
	Understand	**Apply**	**Create**
Human-centred mindset	Critical Reflections on AI	Safe and Responsible Use	Self-actualization in the AI Era
Ethics of AI	Human Agency	Ethics by Design	AI Citizenship
AI Foundations	Data, Algorithms, and Models	Programming and Data Analysis	Modeling and Visual Representations
AI skills	AI Techniques and Applications	AI Programming	Creating AI Products
AI for problem solving	Problem Scoping	Co-design	Co-creation and Feedback Loops

UNESCO, 2023

Keine neuen Kompetenzen



Den didaktischen Raum bespielen

Lernende

Vorwissen

Vorerfahrung

- Selbstregulation
- Koregulation
- Externe Regulation

Lehrende

Funktionale Aspekte

- Werkzeuge
- Prompts
- Plattformen
- Medien

Inhaltliche Aspekte

- Fakten
- Konzepte
- Prozeduren
- Theorien

Bewertende Aspekte

- Modelle
- Heuristiken
- Analogien
- Probleme

Lodge, de Barba, Broadbent, 2023

Passende didaktische Ansätze

Projektbasiertes Lernen

Problembasiertes Lernen

4CID

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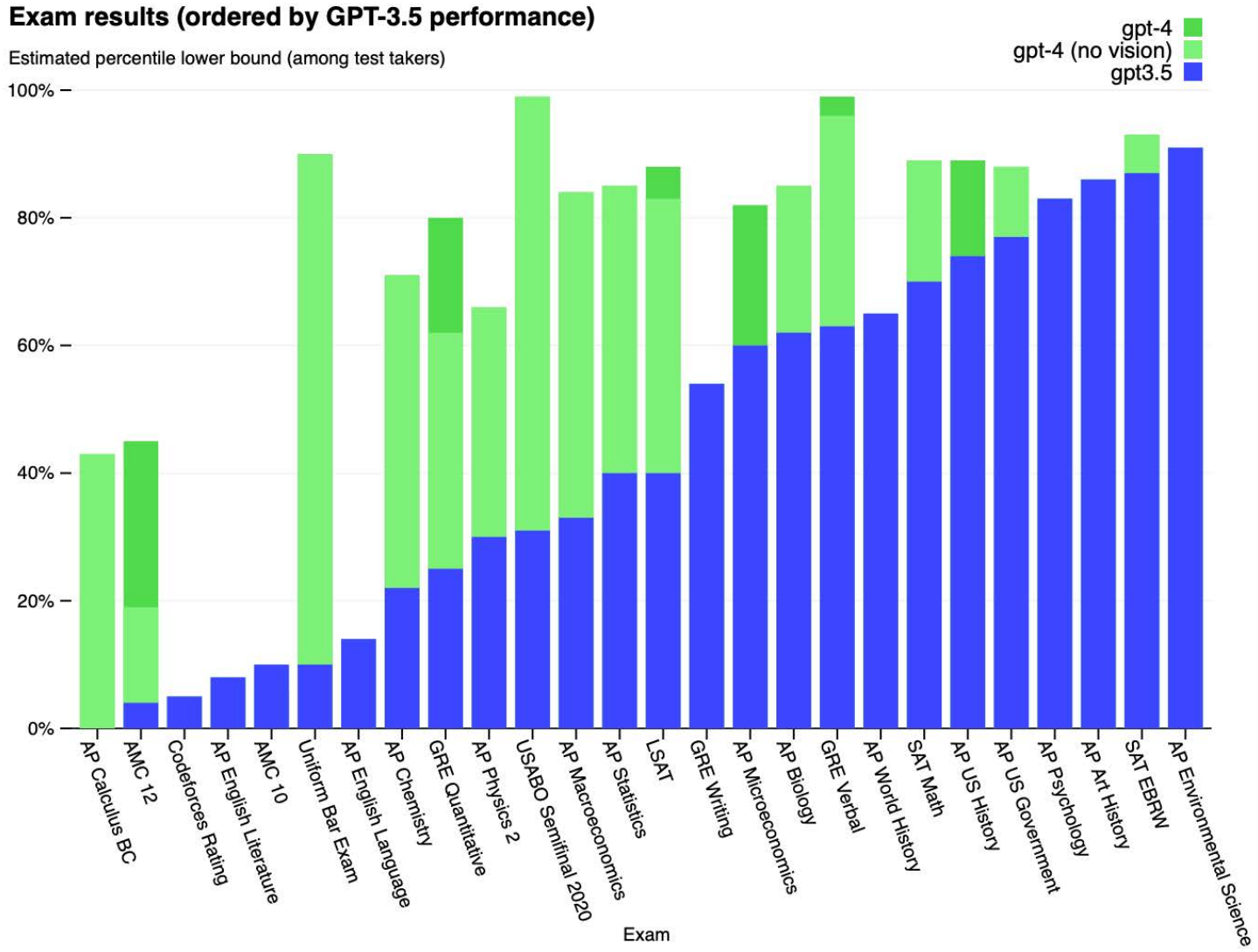
04

Herausforderungen

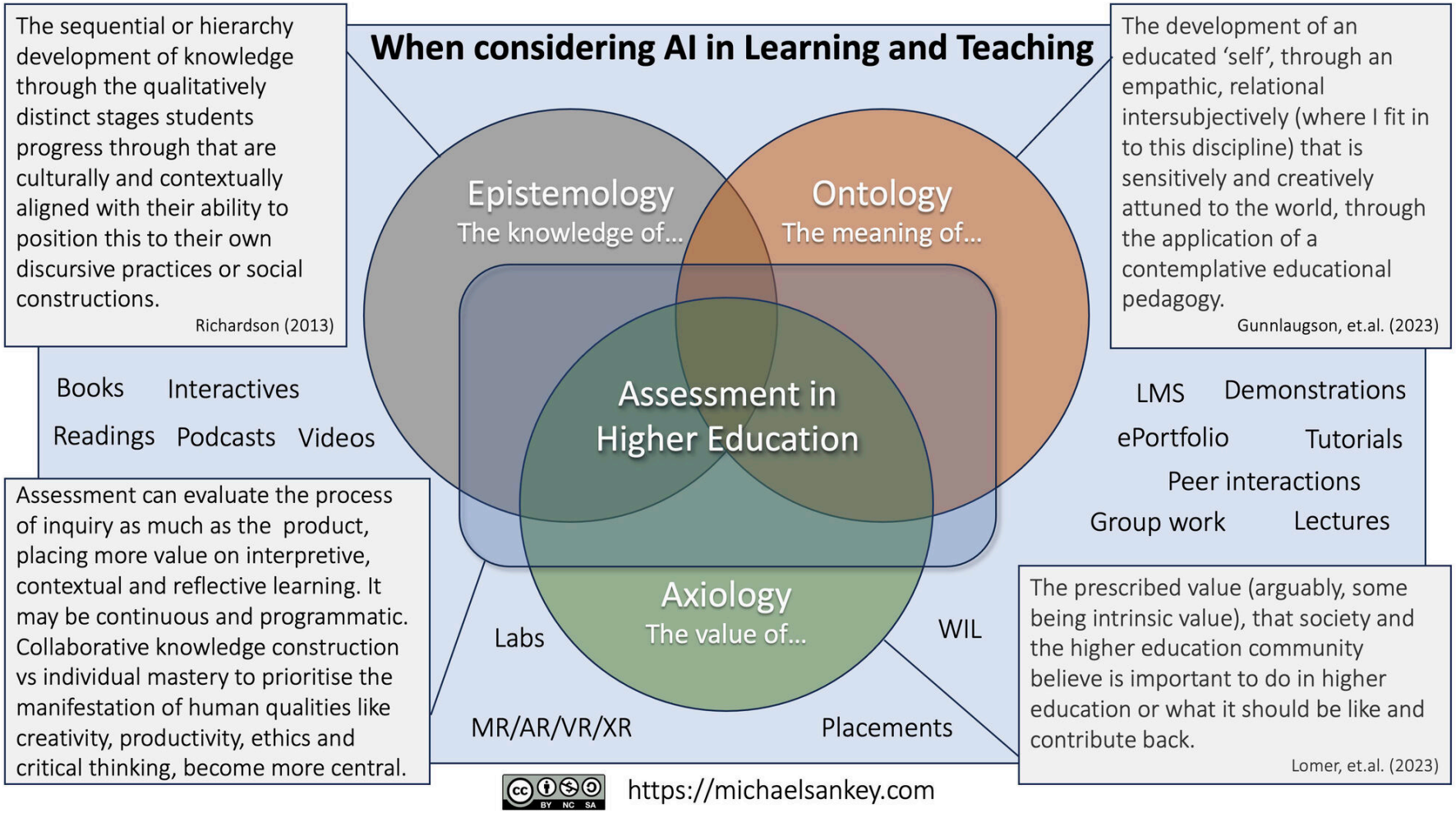
… der Hochschuldidaktik im Zeichen von KI

Praktische Implikationen



OpenAI, 2023

Didaktische Implikationen: Epistemologie, Ontologie, Axiologie



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Lomer, S., Mittelmeier, J., & Courtney, S. (2023). Typologising internationalisation in UK university strategies: reputation, mission and attitude. Higher Education Research & Development 42(5), 1042-1056. DOI: https://doi.org/10.1080/03075079.2022.2130230

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Sankey, 2023

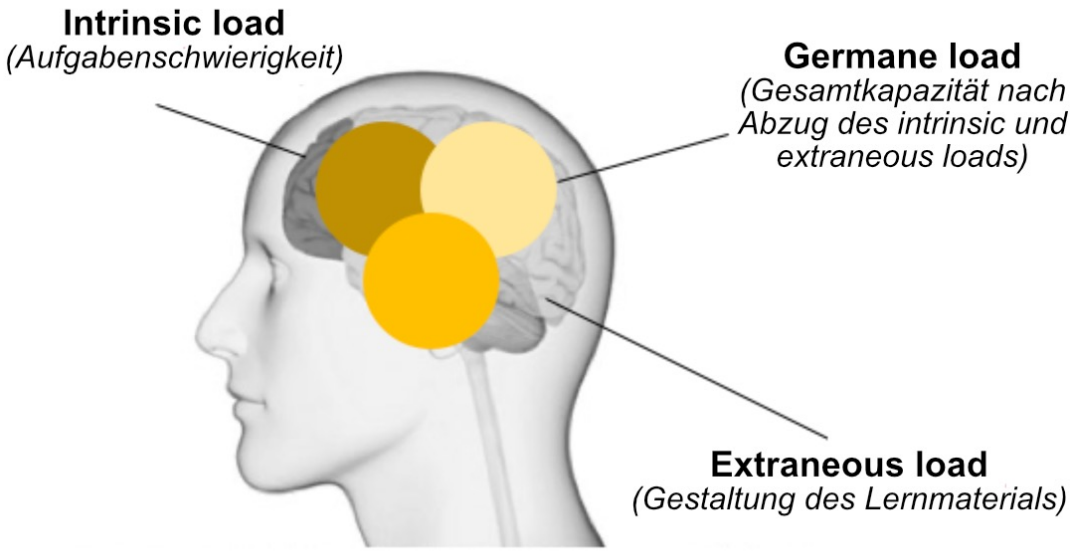
Epistemische Implikationen

Jack Ma on the future of education at the World Economic Forum 2018

Disclaimer: Edited by me

Didaktische Implikationen: Kognitives Abladen

Arten kognitiver Belastung



Drei Arten kognitiver Belastung,
Quelle: In Anlehnung an Sweller, 1994

- Auslagern von kognitiv anspruchsvollen Aufgaben an ein externes Werkzeug
- oder an ein KI-Tool

Allpaka, 2022

Didaktische Implikationen: Kognitives Abladen

Open access | Research article | First published online March 22, 2021

Consequences of cognitive offloading: Boosting performance but diminishing memory

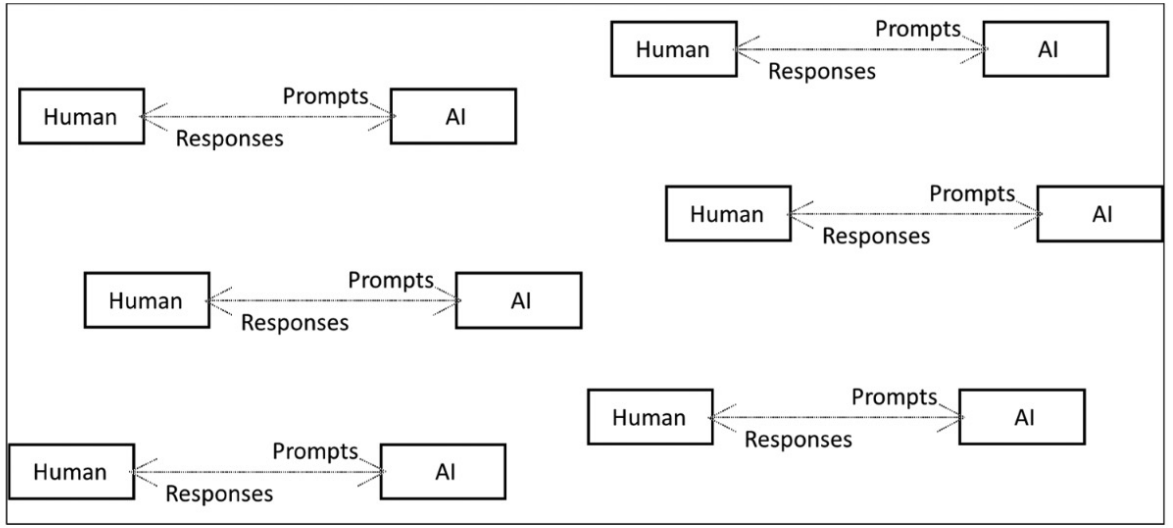
Sandra Grinschgl, Frank Papenmeier, and Hauke S Meyerhoff View all authors and affiliations

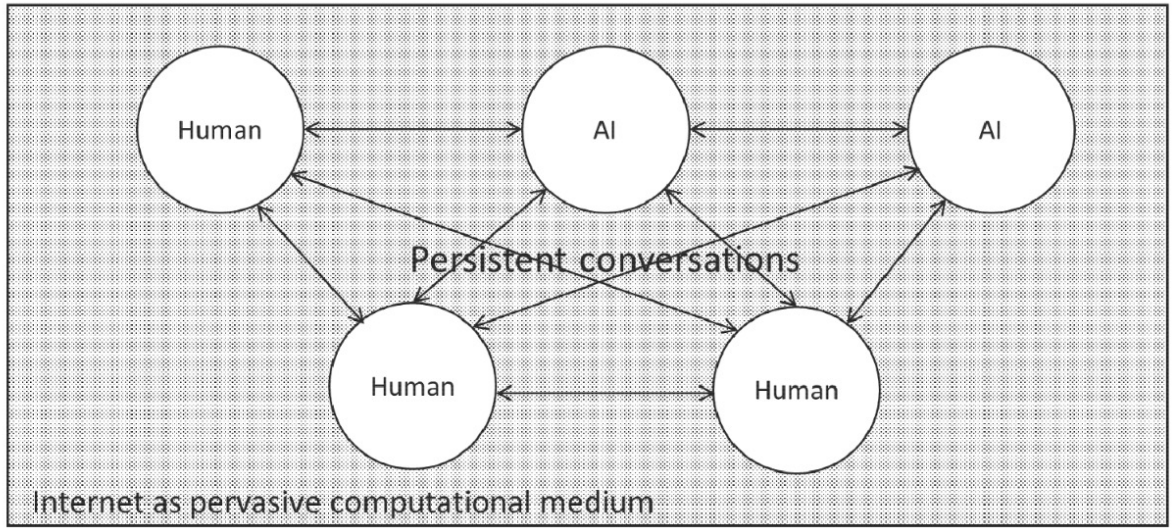
Volume 74, Issue 9 | https://doi.org/10.1177/17470218211008060

Auslagern kann kurzfristig Performance erhöhen, aber langfristig Behaltensleistung vermindern

Grinschgl, Papenmeyer & Meyerhoff, 2021

Von der 1-zu-1 Interaktion zum didaktischen Raum

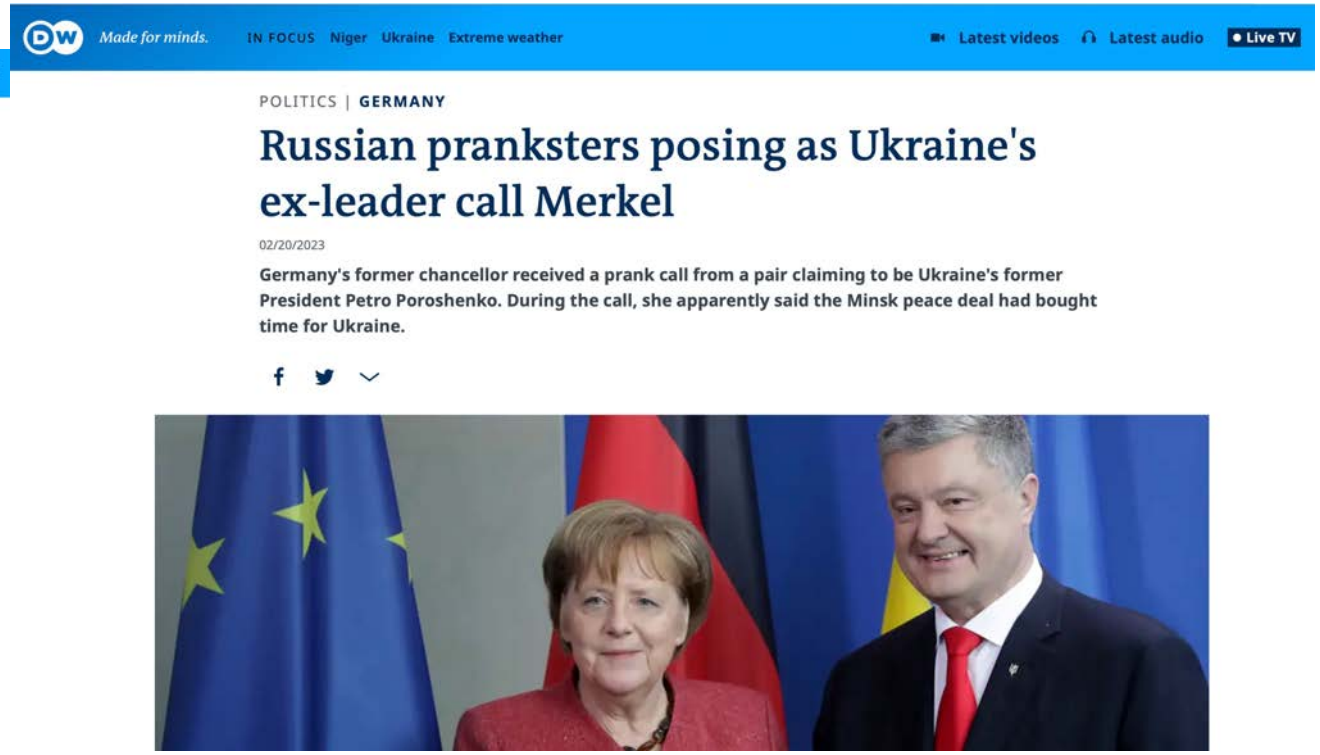




Sharples, 2023

Epistemische Implikationen

Epistemische Implikationen



Epistemische Implikationen

"ChatGPT rejects any notions of creative struggle, that our endeavours animate and nurture our lives giving them depth and meaning. It rejects that there is a collective, essential and unconscious human spirit underpinning our existence, connecting us all through our mutual striving. ChatGPT is fast-tracking the commodification of the human spirit by mechanising the imagination. It renders our participation in the act of creation as valueless and unnecessary."

Nick Cave, 2023

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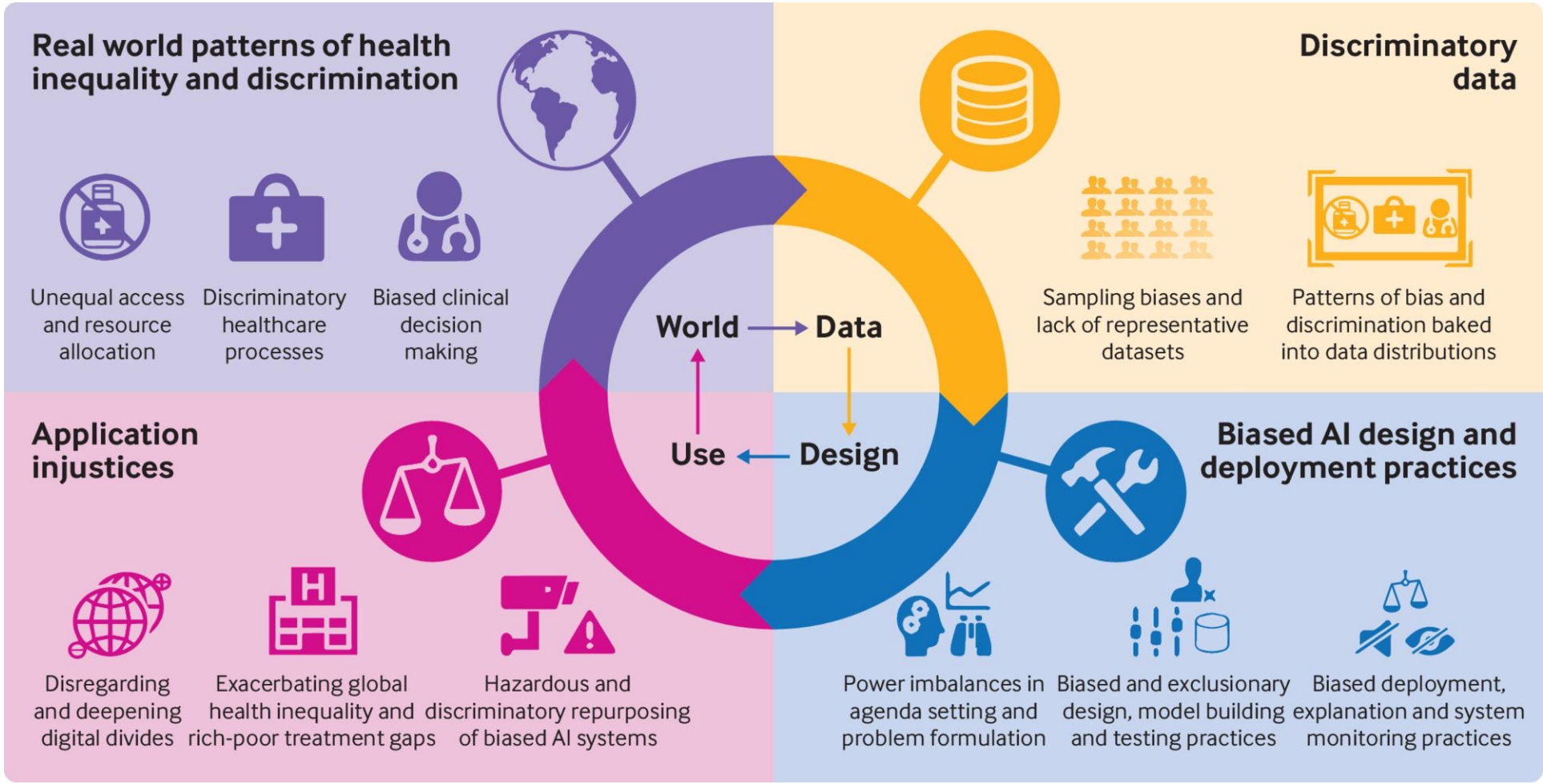
05

Reflexion

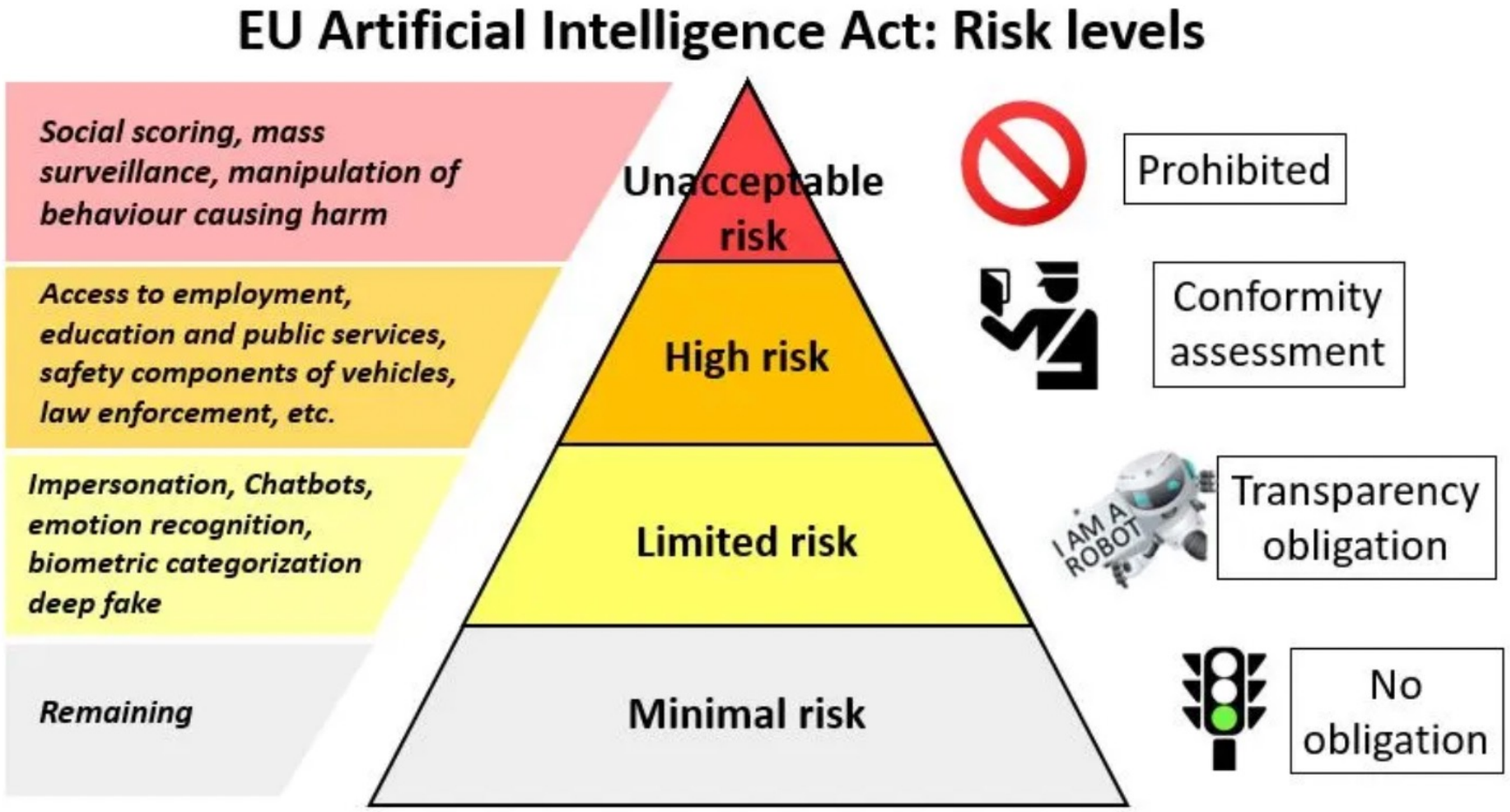
… und Ausblick

Ethische Implikationen



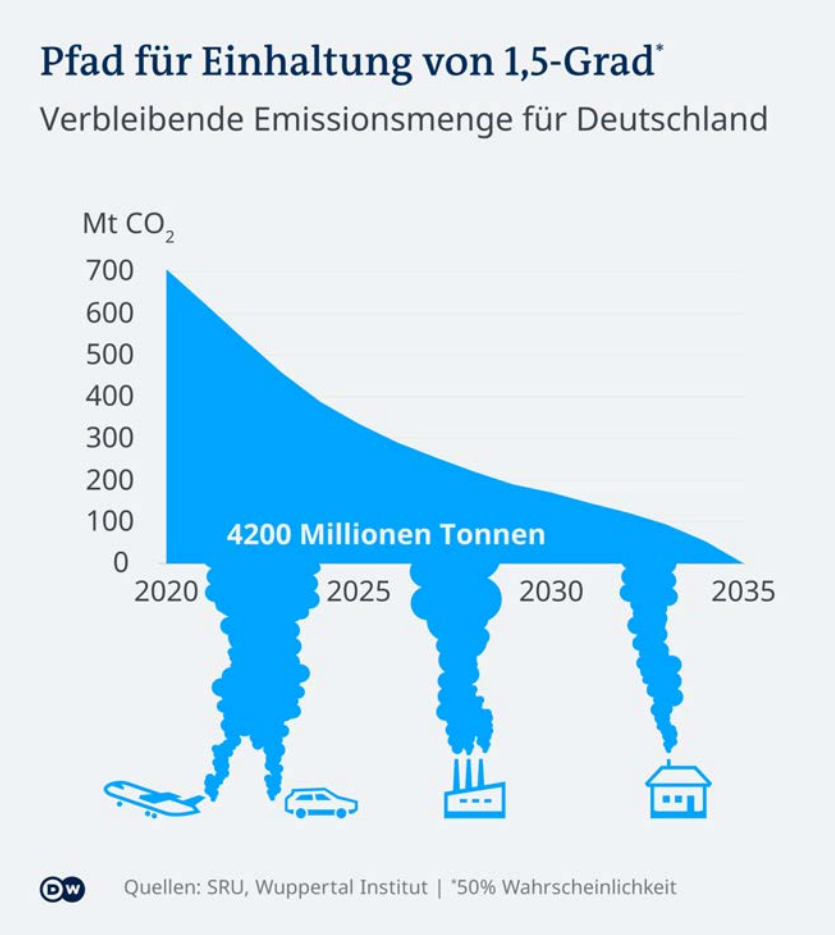
Leslie et al., 2021

Ethische Implikationen



(Source: Telefónica)

Ökologische Implikationen



Deutsche Welle, 2020

ChatGPT deutlich ressourcenhungriger

Bei **GPT-3** von OpenAI verursacht ein Training schon mehr Emissionen. ***552 Tonnen*** sollen es laut Forscher*innen von Google und der Universität Berkeley sein, **1.287 Megawattstunden Energie** wurden zum Training benötigt. Das entspricht dem Energieverbrauch von **320 Vierpersonenhaushalten** in einem Jahr. Die erste Version des Bildgenerators Stable Diffusion wurde 200.000 Stunden lang in Amazons AWS-Rechenzentren an der US-Ostküste trainiert und soll dabei 15 Tonnen CO2-Äquivalent erzeugt haben.

Forschung & Entwicklung im Dienst von OpenAI?

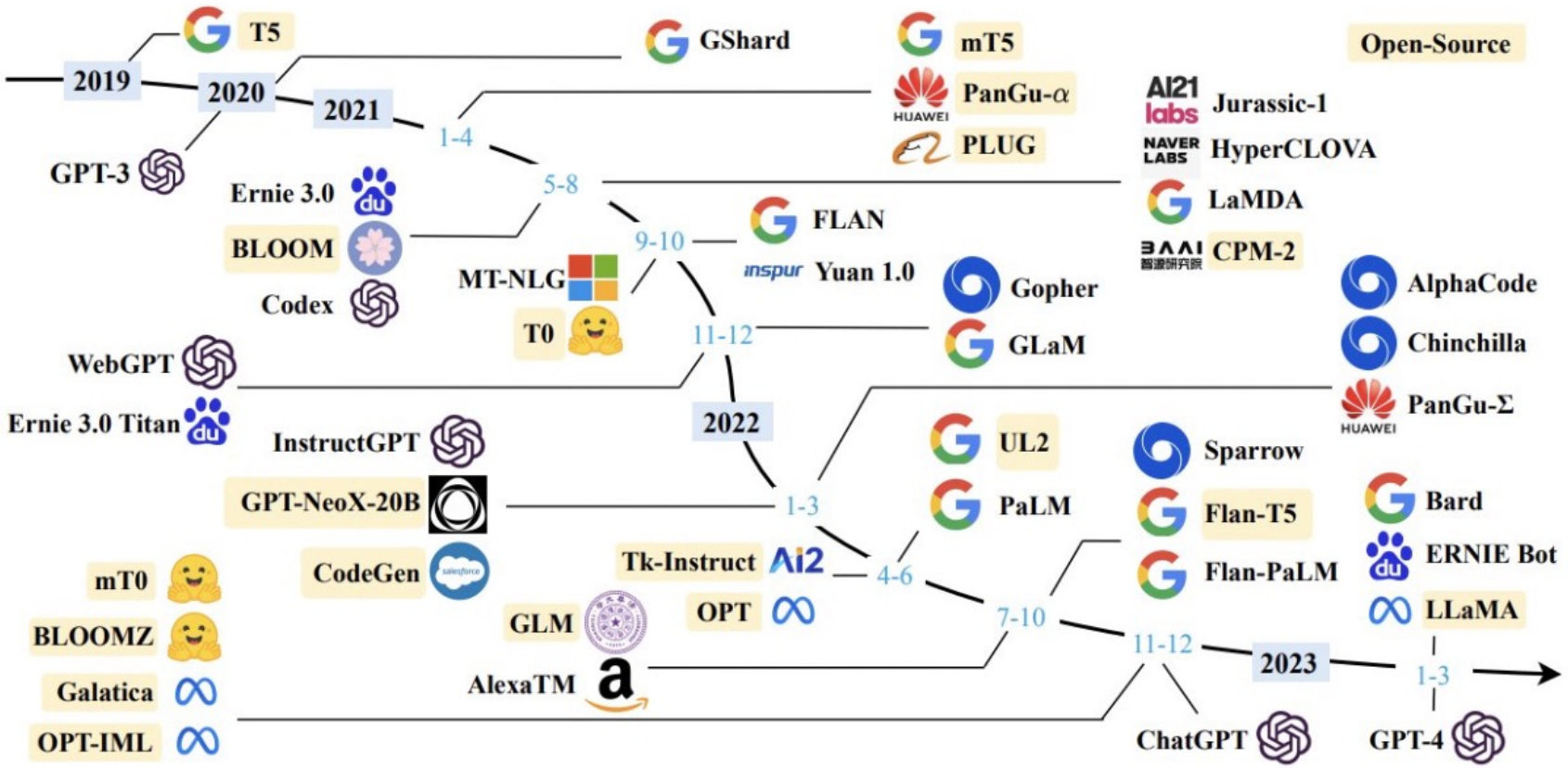


Fig. 1. A timeline of existing large language models (having a size larger than 10B) in recent years. We mark the open-source LLMs in yellow color.

Nextbigfuture, 2023

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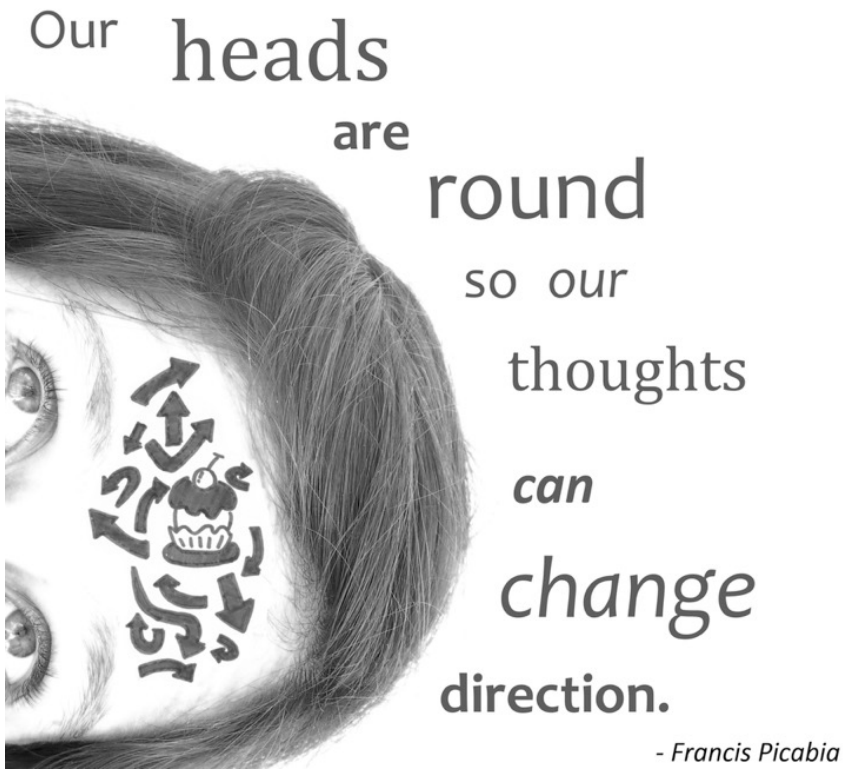
https://kalz.cc/notes/pum23

Danke!

Fragen? Anmerkungen? Kommentare?



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