

Advanced Web Technologies VL

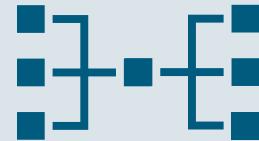
Interoperable AI-supported Learning Technologies

Dr. Christopher Krauss | 22.01.2024 | © Fraunhofer FOKUS



Agenda

1



Interoperability Standards to Enable Future-Proof Education Ecosystems

2



Artificial Intelligence to Support Learning and Teaching

Fraunhofer FOKUS

Learning Technologies

Adaptive, interoperable educational technologies for the federal government, the states, and the economy

- Evaluating existing and advising on the development of new education ecosystems (e.g. prototype **Nationale Bildungsplattform**)
- Development of AI-based services to increase learning efficiency and effectiveness (e.g. AI LMS study for **Bundeswehr**)
- Harmonisation and standardisation of data flows, interfaces, and formats (e.g. **SchulConneX Standard**)
- Seamless integration of licensed content into learning platforms (e.g. with Verband Bildungsmedien with **Cornelsen, Klett & Westermann**)
- Addressing challenges and creating added value through modern technologies (e.g. **data wallets, artificial Intelligence, learning recommendation systems, learning analytics, Metaverse**)

 mEDUator	A prototype of Nationalen Bildungsplattform (NBP) (2020 – 2021)	 KI in LMS	Research study for AI in LMS (2020 – 2025)	 triple adapt	AI-Learning support at the manual working station (2021 – 2024)	 LOGINEO NRW	Future check of NRW-Bildungsplattform (2022 – 2023)
 moin.schule	School registration service Niedersachsen (2022 – 2024)	 control & connect	School licence management (NBP) (2022 – 2024)	 EXPANDER WB³	Semantic search for professional training (2021 – 2024)	 SPRINGER NATURE masterclasses	Consultancy on the conception of new learning platforms (2022 – 2023)



1

Interoperability Standards to Enable Future-Proof Education Ecosystems

Reference Project

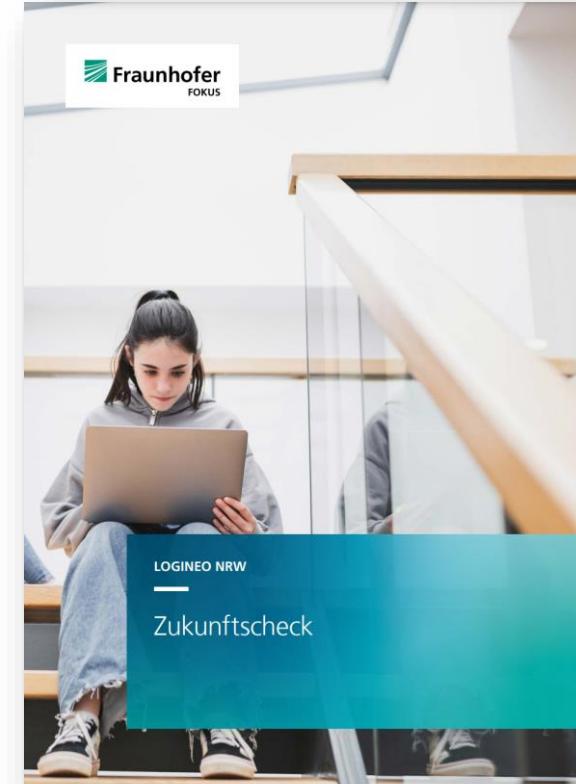
Zukunftscheck LOGINEO NRW

Task:

- The LOGINEO NRW future check is an independent analysis that examined various levels of LOGINEO NRW.
- The aim of the check was to examine whether the continued use of LOGINEO makes sense and, if necessary, to make recommendations for further use.

Methodology:

- Analysis of extensive documentation & evaluation of comments and remarks from 20 pilot schools
- Initial classification of LOGINEO NRW in a state comparison
- Evaluation of the results from 12 workshops with various stakeholders (including the LOGINEO NRW working group, the school supervisory board, some schools, the LOGINEO NRW practice committee and media advisors)



On behalf of:

Ministerium für
Schule und Bildung
des Landes Nordrhein-Westfalen

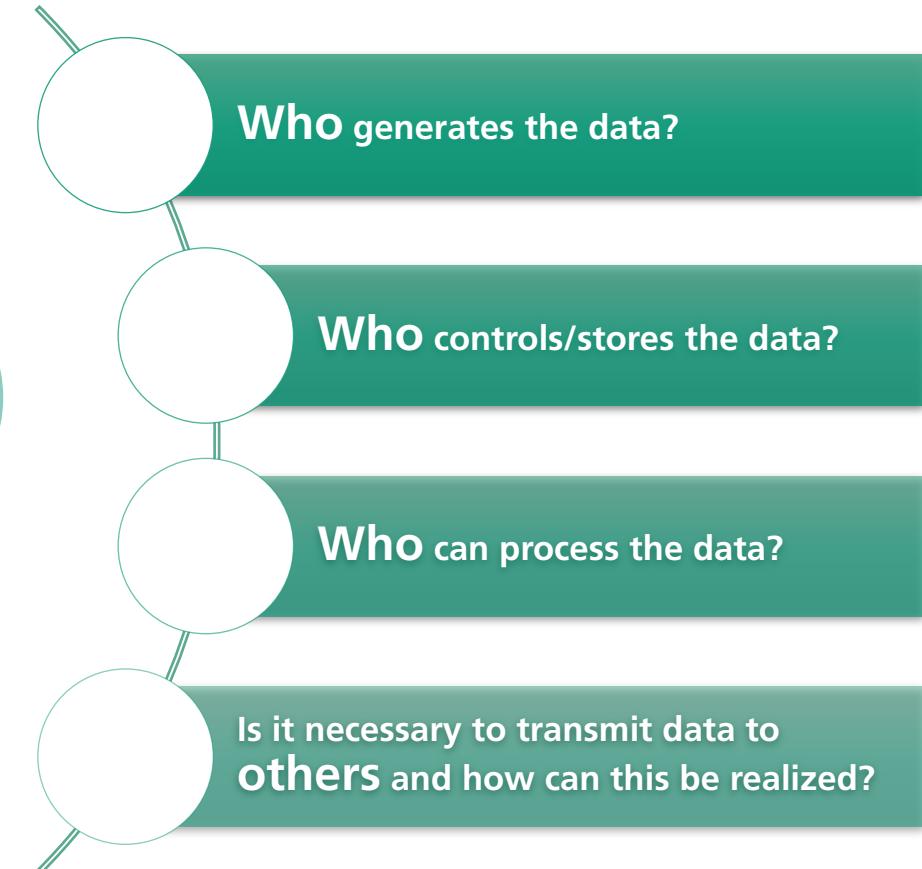
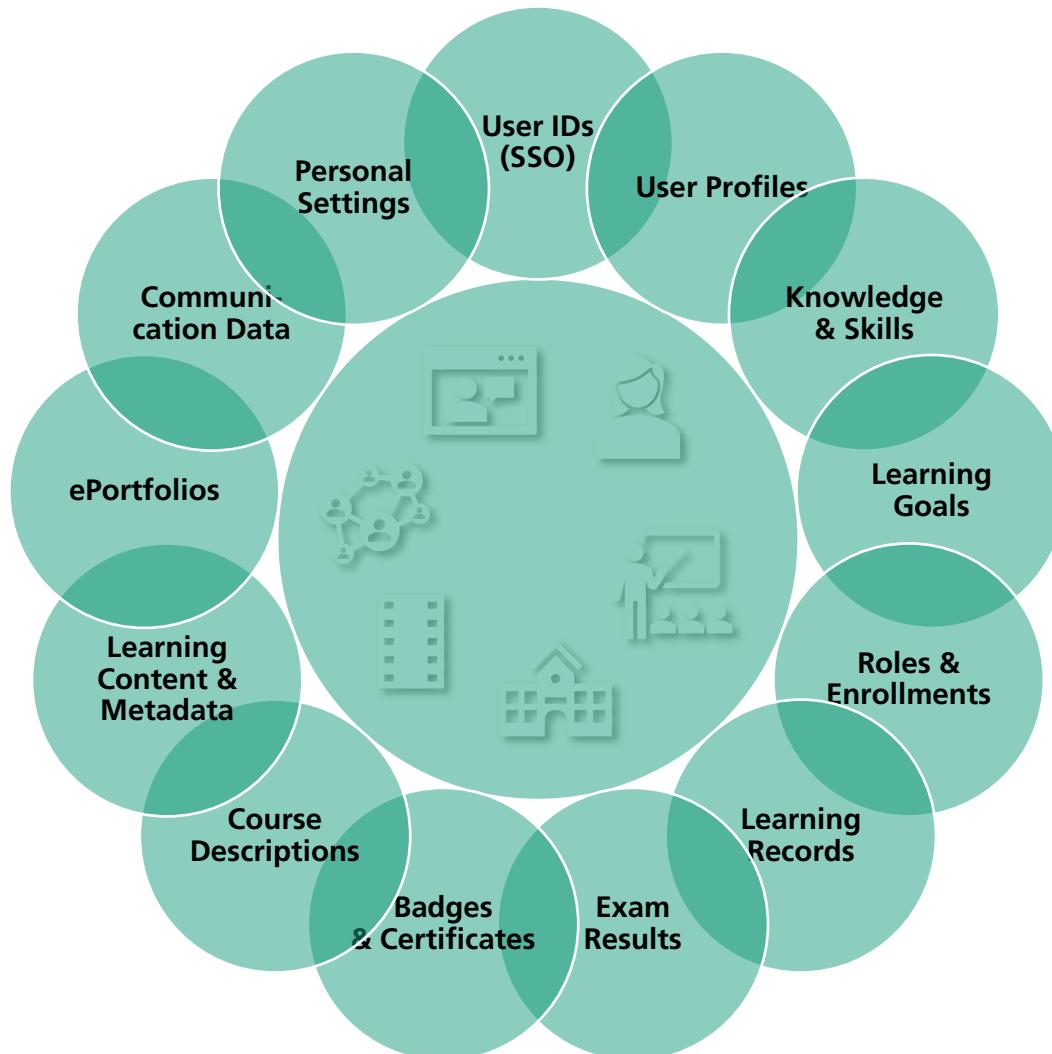


Inhalt

1. Einleitung	4
1.1. Hintergrund zum Zukunftscheck LOGINEO NRW	4
1.2. Digitalpakt Schule	4
1.3. Entwicklungsschub Pandemie – Chancen und Risiken	5
1.4. Die wichtigsten Stakeholder	6
2. LOGINEO NRW	7
3. Vorgehensweise und Methodik	10
3.1. Ist eine digitale Schulplattform notwendig?	11
3.2. Deckt LOGINEO NRW den aktuellen Bedarf?	11
3.3. Bleibt LOGINEO NRW auch zukünftig nutzbar?	12
4. Evaluation der Pilotphase von LOGINEO NRW im Rahmen der Mitbestimmung	13
5. Vergleich zu digitalen Schulplattformen anderer Bundesländer	15
6. Workshops im Januar und Februar 2023	18
6.1. Workshopstruktur	18
6.2. Workshopresultate	21
7. Softwarequalität – LOGINEO NRW als Softwareprodukt	25
8. Lernangebote LOGINEO NRW LMS	27
8.1. Bereitstellung von Tools und Rhythmen zur Erstellung eigener Kursinhalte	27
8.2. Bereitstellung und Integration eines weiten Angebotes von Inhalten	27
8.3. Möglichkeiten zur Datenauswertung schaffen	28
8.4. Lernende direkt in LOGINEO NRW Entwicklungen involvieren	29
9. Zukunftsredundante Lernmanagementsysteme und Schulplattformen	30
9.1. Nutzenden Nutzungsvertriebs	30
9.2. Einfache Integration neuer Komponenten	30
9.3. Nutzung auf mobilen Geräten	30
9.4. Höhere Motivation beim Lernen	31
9.5. Einsatz künstlicher Intelligenz	32
9.6. Schnittstellen und Standards	33
9.7. Reporting und Analytics	33
9.8. Dauerhaftigkeit über den Kurs hinaus	33
9.9. Weitere Trends	34
10. Resultat Zukunftscheck	35
Literaturverzeichnis	38
Anhang: Detaillierte Darstellung der Anregungen und Erfahrungen aus den Workshops	39
Impressum	57

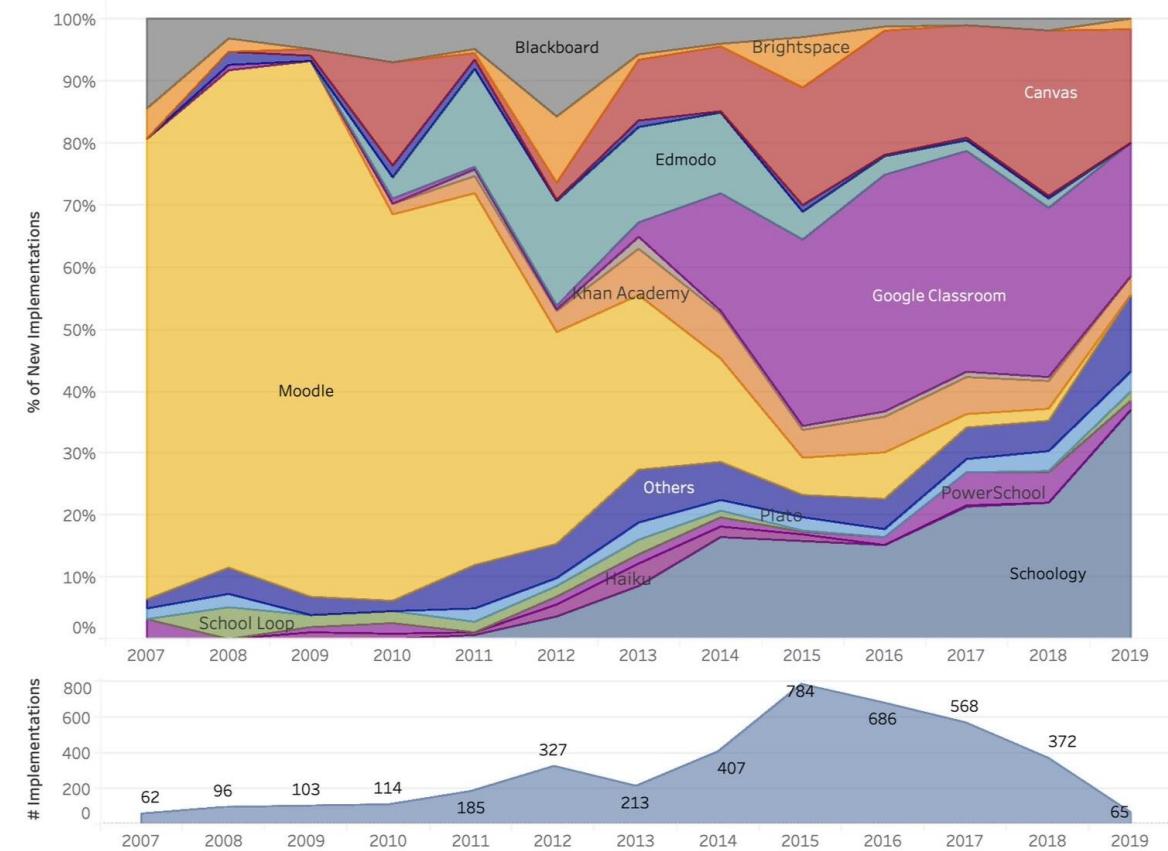
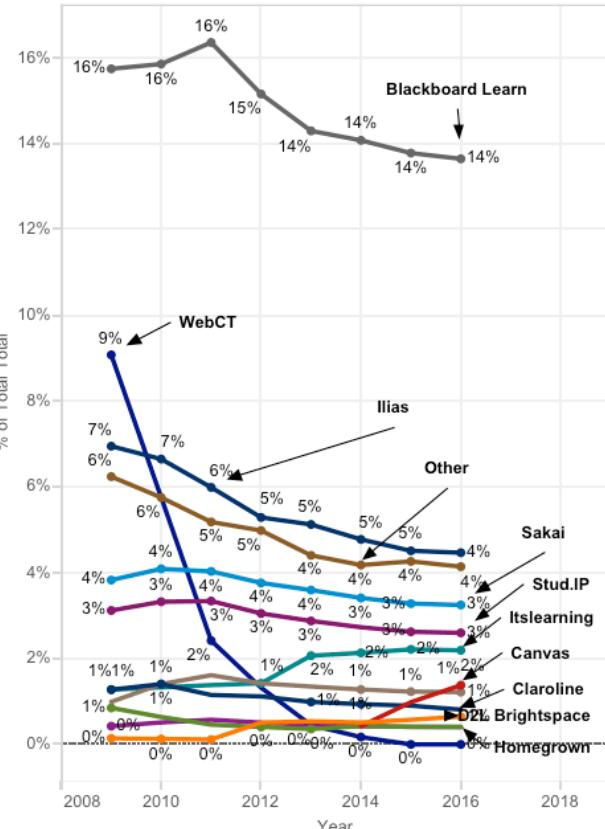
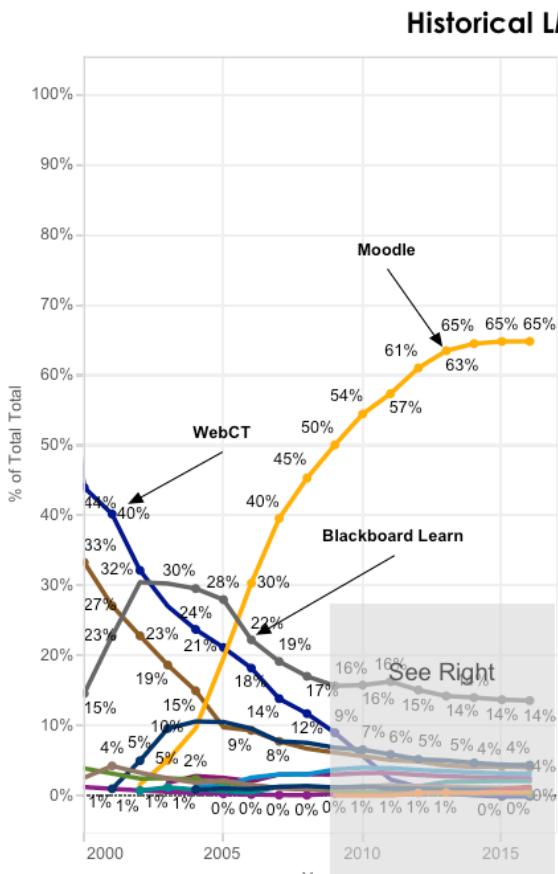
State of the Art

Data in Typical Educational Ecosystems



State of the Art

LMS: Changing market leaders in Europe



Considerations for a Future-Proof System Architecture

Analysis of the Interoperability of 53 LMS

Learning Management Systems*	OS vs. Prop. / free vs. comm.	SCORM	xAPI	Common Cartridge	LTI	cmi5
Absorb LMS	Prop. / comm.	2004 4th Edition	supported	prob. no support	prob. no support	prob. no support
Adobe Captivate Prime	Prop. / comm.	2004 4th Edition	prob. no support	prob. no support	prob. no support	prob. no support
BenchPrep	Prop. / comm.	supported	supported	prob. no support	LTI 1.3	prob. no support
Blackboard	Prop. / comm.	2004 4th Edition	supported	prob. no support	supported	prob. no support
<i>...shortened List...</i>						<i>...shortened List...</i>
Totara Learn	OS / free	SCORM 1.2	supported	supported	supported	prob. no support
Tovuti	Prop. / comm.	2004 4th Edition	prob. no support	prob. no support	prob. no support	prob. no support
Tutor	OS / free	prob. no support	prob. no support	prob. no support	supported	prob. no support
Udacity	Prop. / comm.	prob. no support				
WebCT	Prop. / comm.	prob. no support	prob. no support	supported	prob. no support	prob. no support

- 51 LMS can **import or launch content**
- 31 LMS can **make Learning Records available**
- 13 LMS **allow to export or launch content (data)**
- 39 LMS **support SCORM**
- 31 LMS **support xAPI**
- 14 LMS **support Common Cartridge**

* Complete list of 53 evaluated LMSs on request; as of 2021 (Fraunhofer FOKUS).

Considerations for a Future-Proof System Architecture

Strategies to Integrate (AI) Functions



Monolithic systems: The Best-of-Suite Strategy

Focuses on a holistic solution for all concerns.

- **Seamlessly** integrates various functions in a product bundle
- Can be used as a **standard product for various contexts**
- **Consistent look and feel**, uniform usability and smooth interaction of the components
- Data can be **easily processed** throughout the entire system
- A **single service provider** is responsible (and responsive)
- Long-term operation comparatively **expensive** and often comes with a **vendor lock-in**



Service-Oriented Systems: The Best-of-Breed Strategy

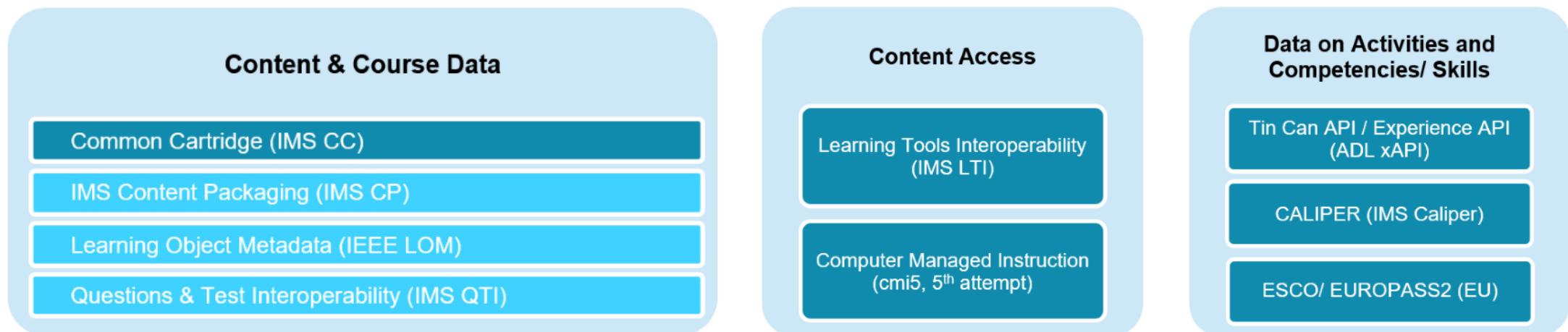
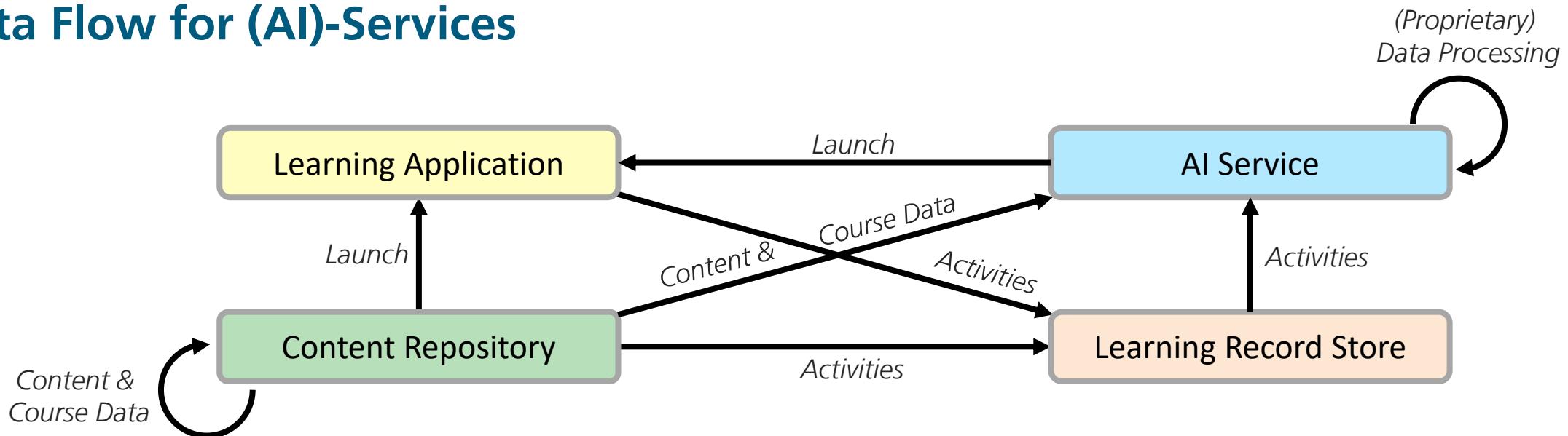
Combines the best of different worlds.

- **Combination of different services** allows for better **customization of the overall system**
- Services **focus on specific tasks** (usually more efficiently)
- Services can be **quickly connected, developed independently** of other services (and **easily be replaced**)
- Requires a **leading system**, which connects all services
- The initial **design of common data flows** and **interoperable interfaces** is **more complex** and **time consuming**

→ The more complex the overall system, the more suitable the Best-of-Breed Strategy!

Considerations for a Future-Proof System Architecture

Data Flow for (AI)-Services



Open Standards

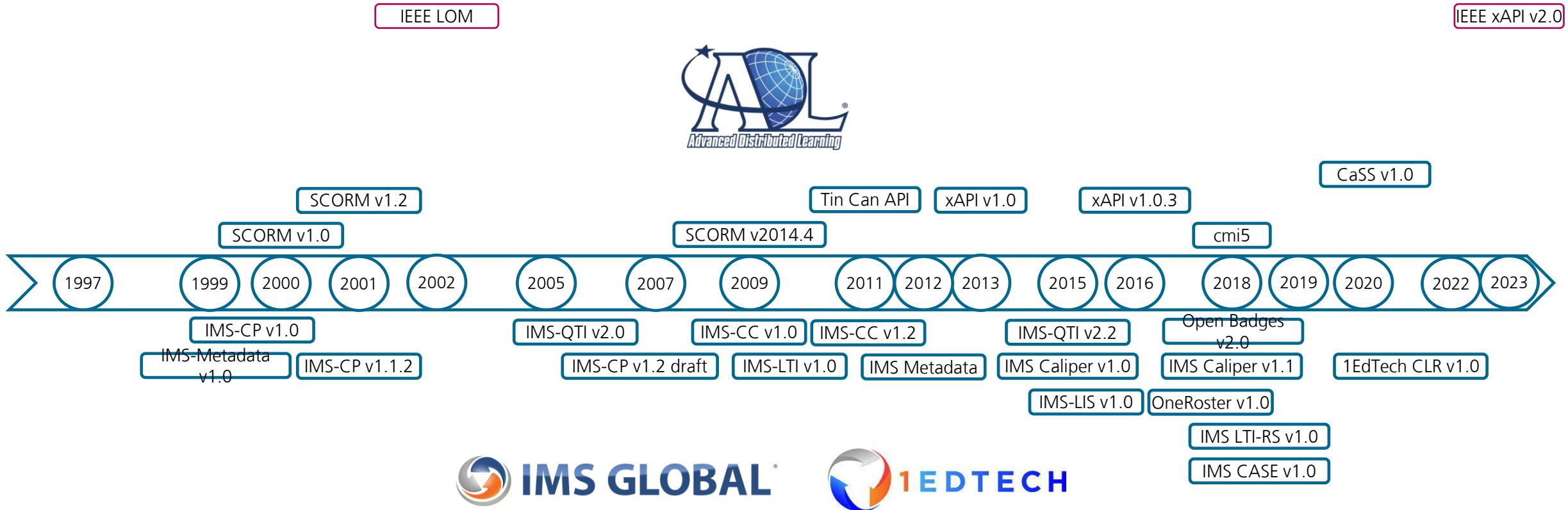
Open Learning Tools & Specifications

- Learning Resource Metadata Initiative (LRMI)
- Aviation Industry Computer-based Training Committee (AICC)
 - HTTP AICC Communication Protocol (HACP)
 - **Computer Managed Instruction – fifth attempt (cmi5)**
- Advanced Distributed Learning Consortium (ADL)
 - Sharable Content Object Reference Model (SCORM)
 - Content Aggregation Model (CAM)
 - Sequencing and Navigation (SN)
 - Run-Time Environment (RTE)
 - **Experience API (xAPI, former Tin Can)**
 - **Computer Managed Instruction – fifth attempt (cmi5)**
- 1EdTech/ Instructional Management System Global Learning Consortium (IMS)
 - **Common Cartridge Specification (CC/ Thin CC)**
 - **Learning Tools Interoperability (LTI)**
 - **Learning Resource Meta-Data (LOM)**
 - **Question and Test Interoperability (QTI)**
 - **Content Packaging (CP)**
 - **CALIPER**



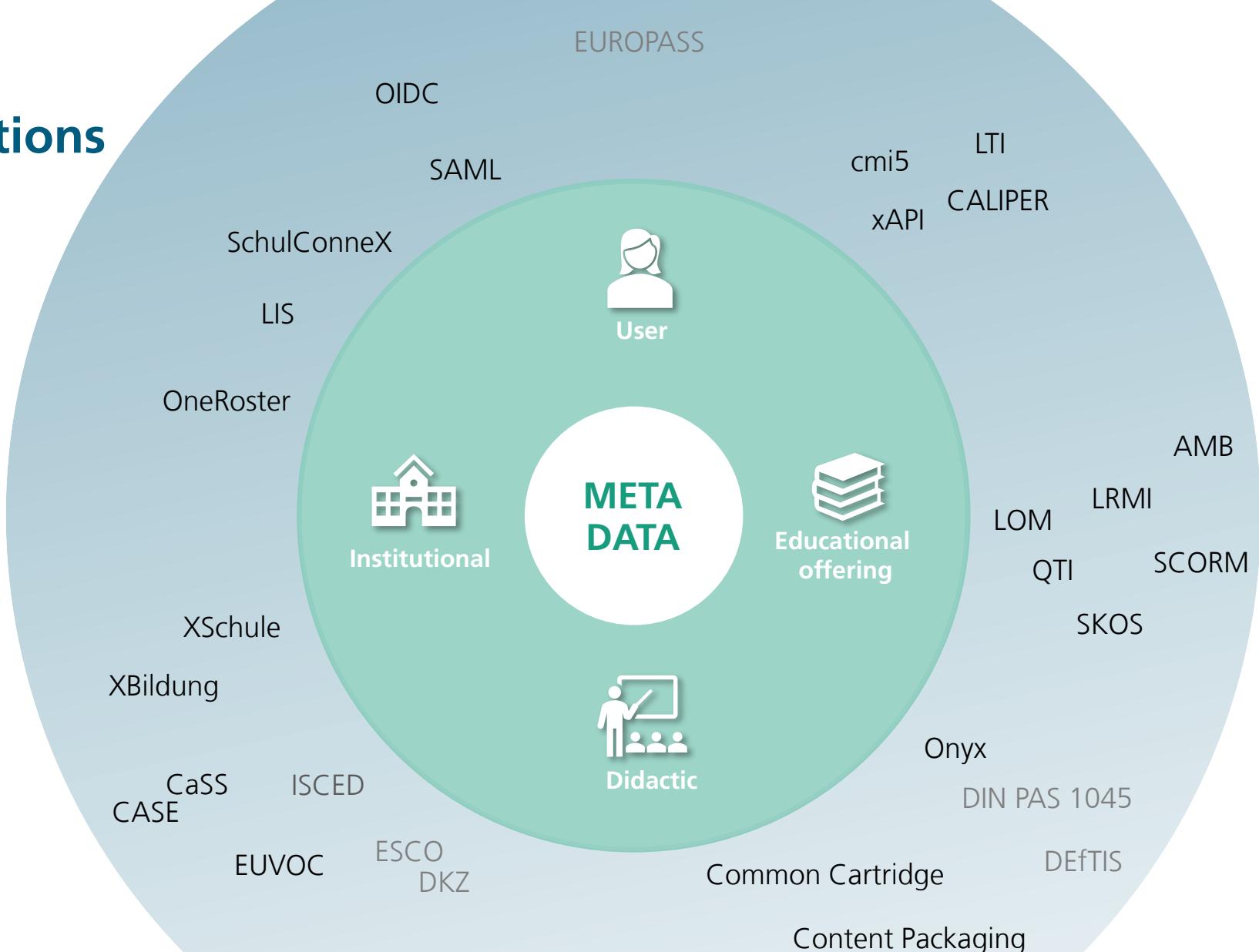
Open Standards

Heterogeneity in interoperability standards



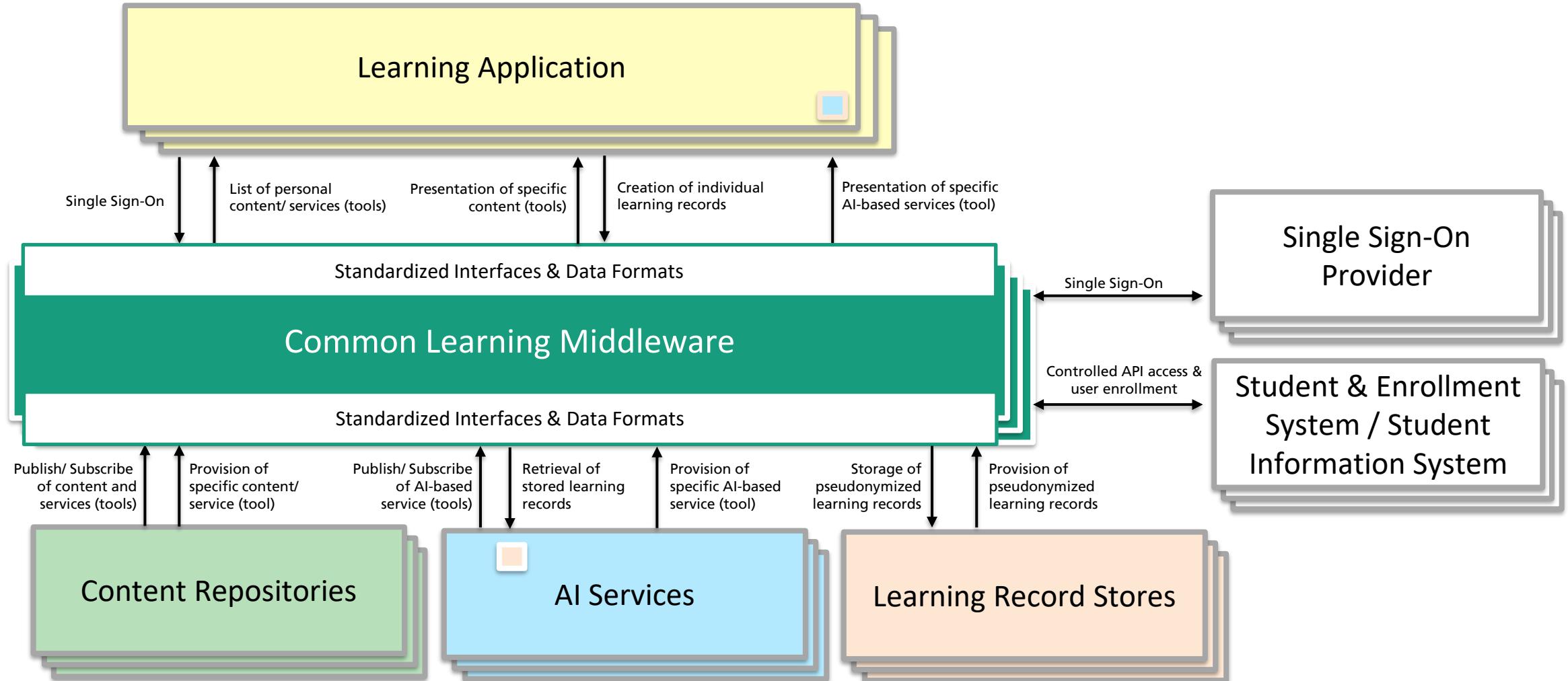
Specifications of ADL and 1EdTech compared; Source: Own illustration (Fraunhofer FOKUS).

Relevant Specifications



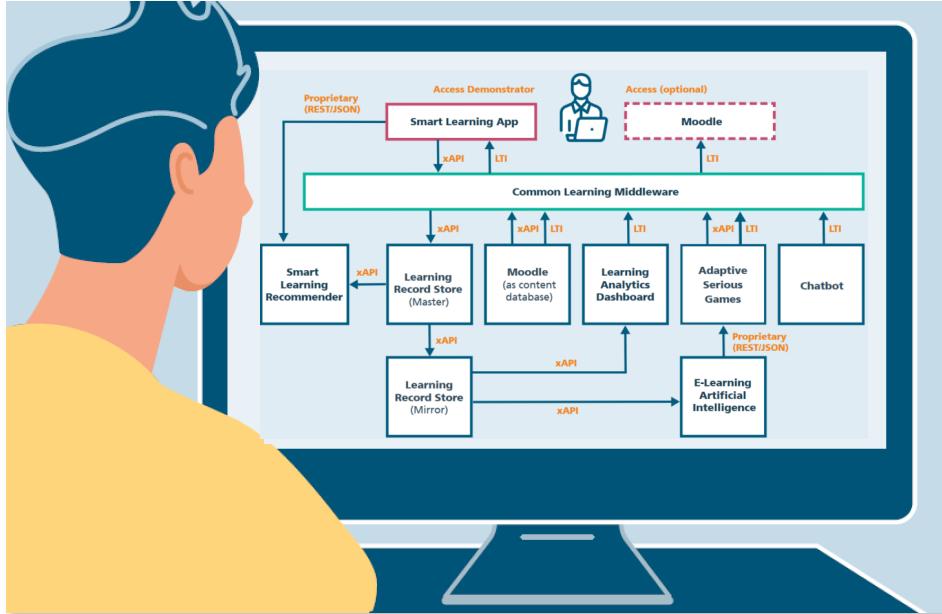
Middleware Concepts

Middleware-based Approach



Middleware Concepts

Applications of the Common Learning Middleware



Source: <https://kilms.fraunhofer.de/>

- The middleware approach has already been tested in various settings
- Prototype of **German National Education Platform "mEDUator"**¹
- Research Study **"AI in LMS"** for the German Armed Forces²
- In various German **government-funded projects** to connect adaptive educational technologies
 - such as **Control&Connect**³, **EXPAND+ER WB**⁴ & **TripleAdapt**⁵

mEDUator
(2020 – 2021)¹


KI in LMS
(2020 – 2024)²


control & connect

(2022 – 2023)³


EXPAND+ER WB

(2021 – 2024)⁴


triple adapt
(2021 – 2024)⁵

1 mEDUator: <https://meduator.fokus.fraunhofer.de/>

2 KI in LMS: <https://kilms.fraunhofer.de/>

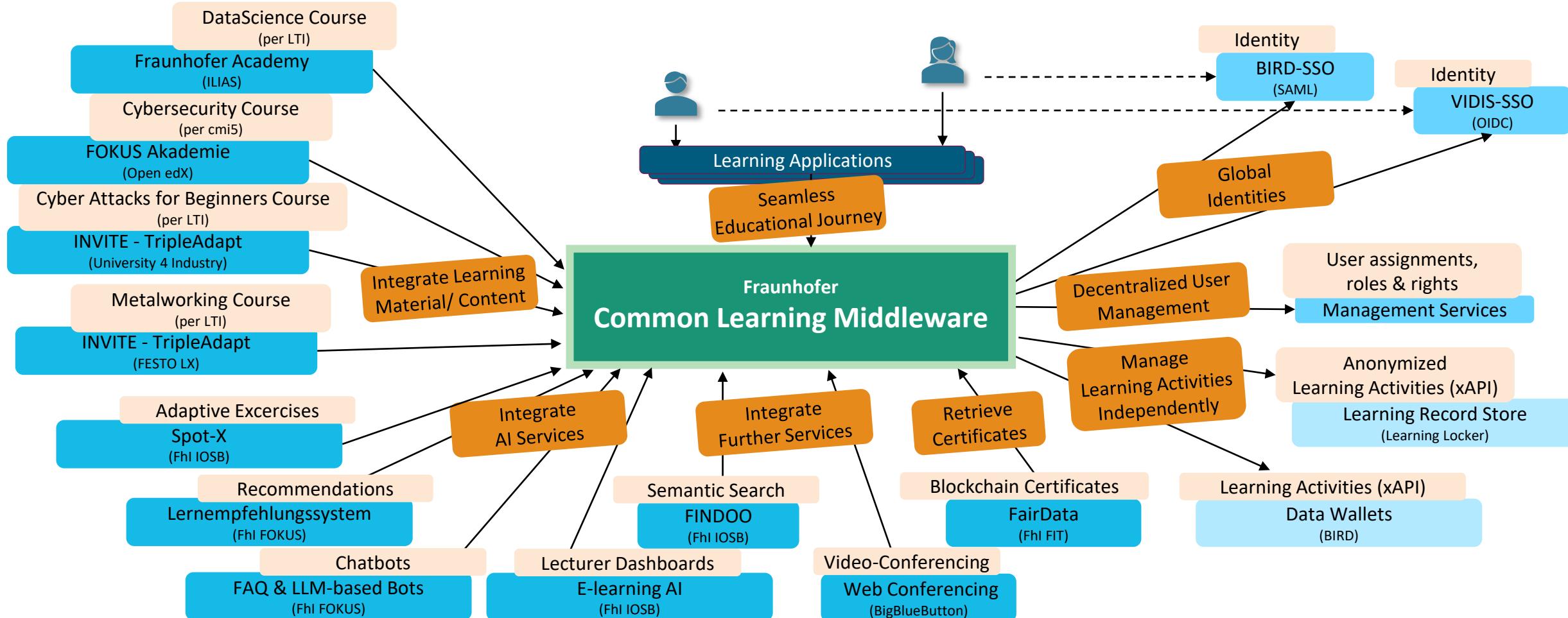
3 Control&Connect: https://www.fokus.fraunhofer.de/en/projects/fame/control_connect_23-05

4 EXPAND+ER WB³ https://www.fokus.fraunhofer.de/en/project/fame/expander_2021-12

5 TripleAdapt: <https://www.fokus.fraunhofer.de/en/fame/projects/tripleadapt>

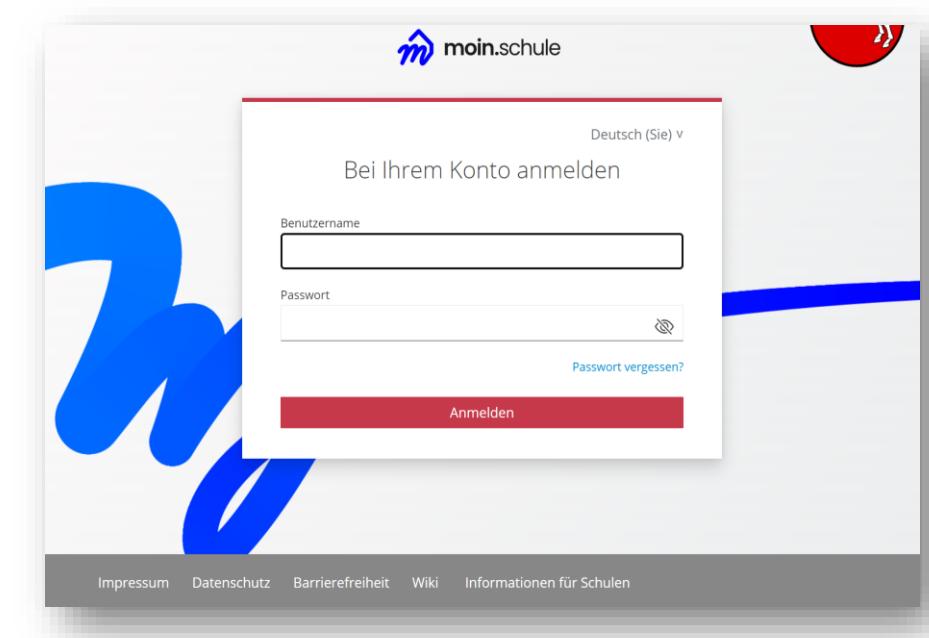
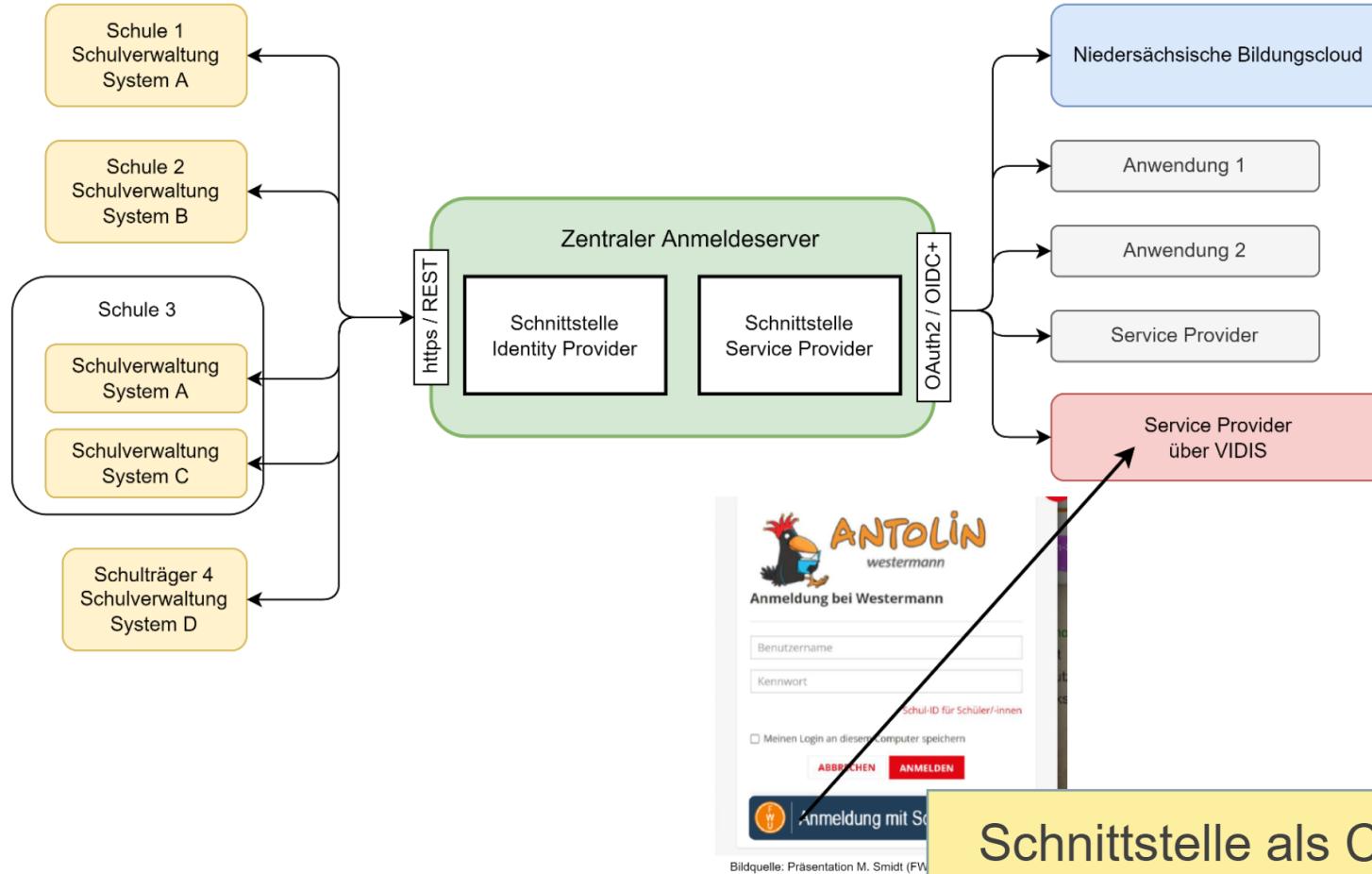
Reference Project

Common Learning Middleware



Technical demonstration of the educational journey as part of an early prototype for the German National Education Platform

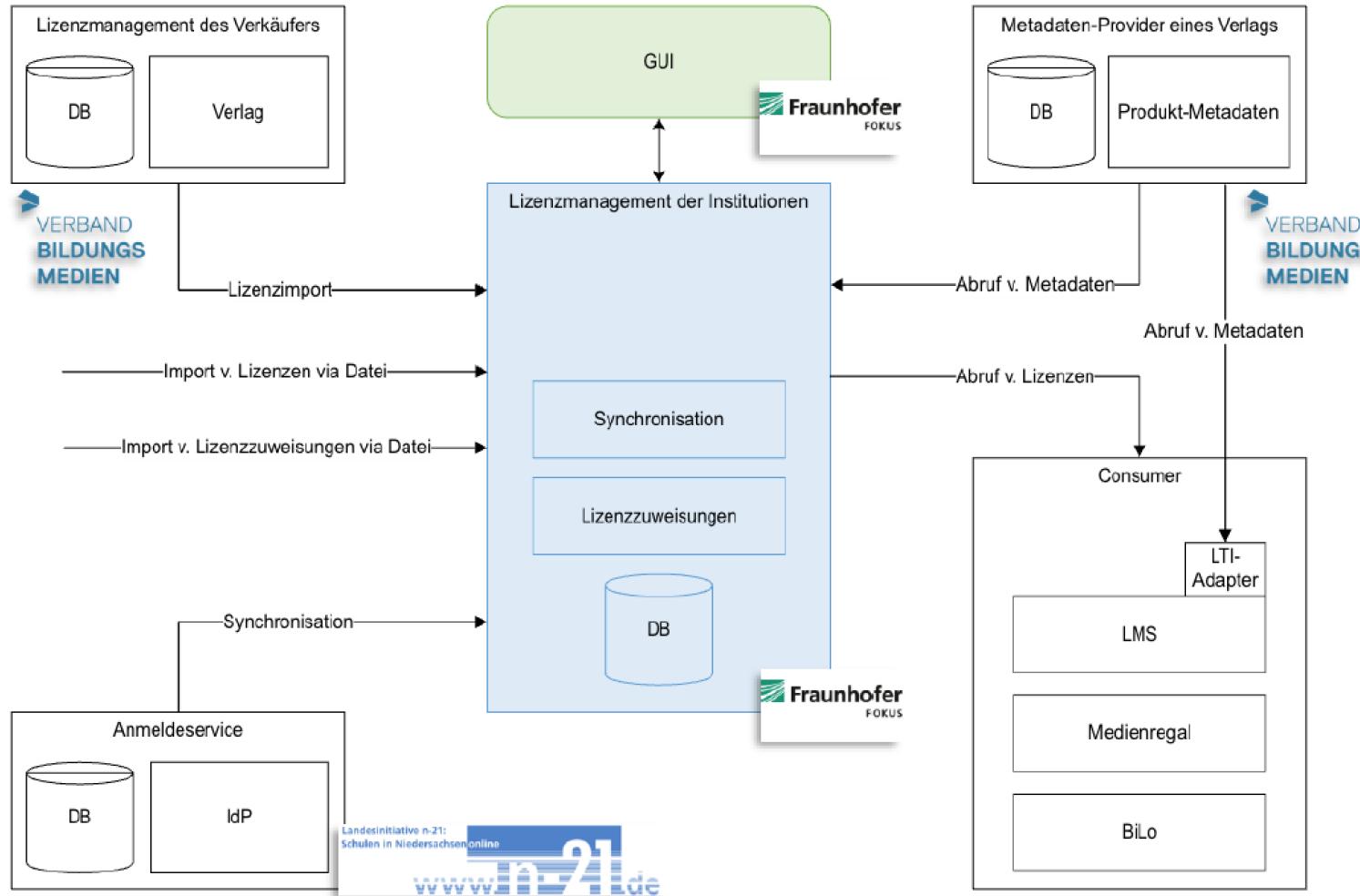
Reference Project moin.schule / SchulConneX



On behalf of:



Reference Project Control & Connect



The dashboard interface includes the following sections:

- Bildungslogin-Test** logo and text: Die Schule, für die eine Zuweisung erfolgt.
- Dashboard** title.
- 1. Wählen Sie eine Funktion:**
 - + Lizenzen importieren
 - + Lizenzen zuweisen
 - Lizenzen im Lizenzmanager anzeigen und durchsuchen
 - Lizenzen im Lizenzmanager anzeigen, suchen und entziehen
- 2. Helpdesk: Anleitung & Hilfe** section with Anleitung ansehen and FAQ buttons.
- MEDIEN**, **LIZENZ IMPORTIEREN**, **LIZENZ ZUWEISEN**, **MEDIEN**, **LIZENZ ÜBERSICHT**, and **RECHTLICHES** (Impressum | Datenschutz) links.

Partner:



GEFÖRDERT VOM





2

Artificial Intelligence to Support Learning and Teaching

What is AI and what does it have to do with education?



Artificial intelligence (AI) describes "computer systems that are capable of **performing tasks** that **normally require human intelligence.**"¹

Alternatively, it is "the **ability of a machine to imitate intelligent human behavior.**"¹

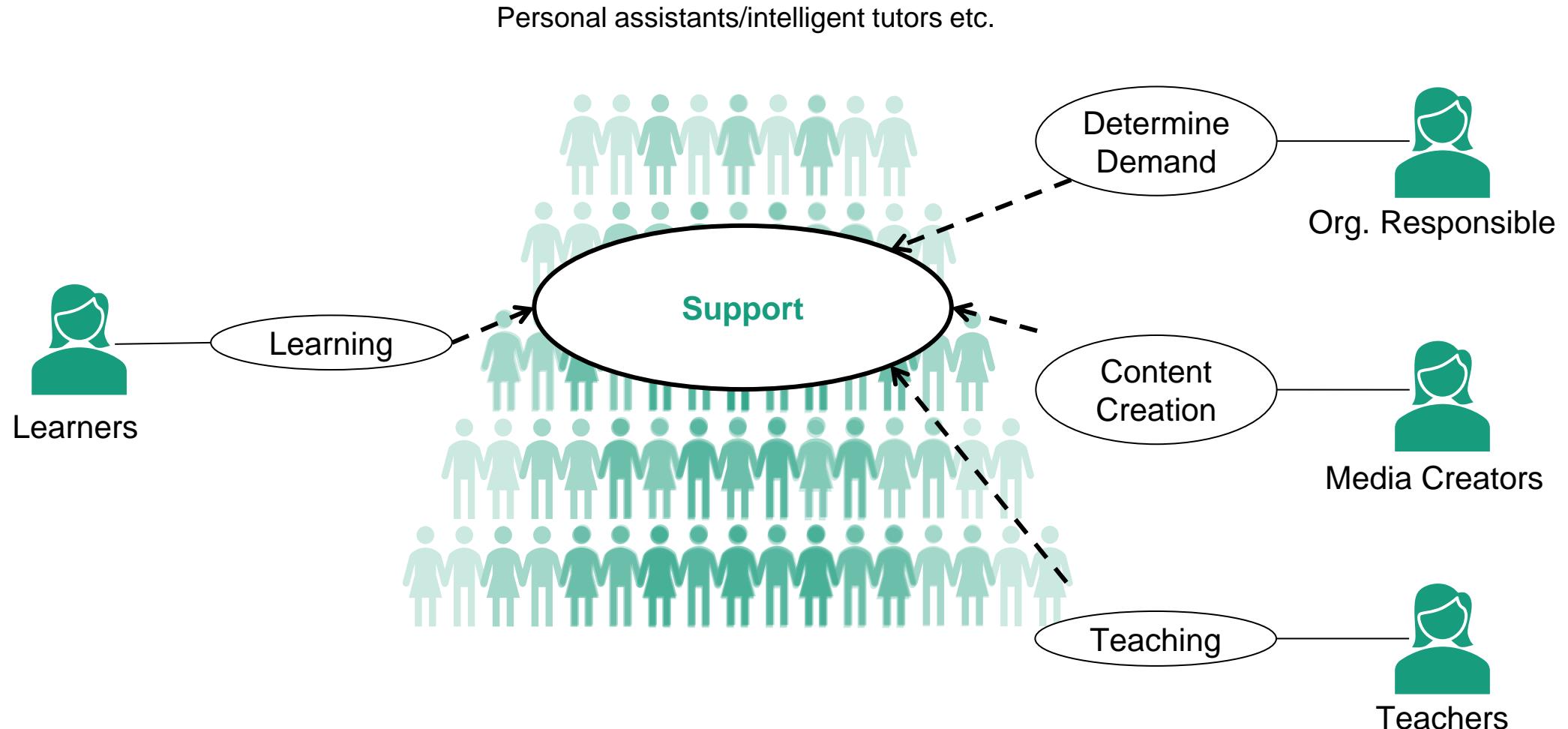
¹ <https://www.forbes.com/sites/bernardmarr/2018/02/14/the-key-definitions-of-artificial-intelligence-ai-that-explain-its-importance/#65f63abc4f5d>

With the currently available **weak artificial intelligence**, "**clearly defined tasks** can be mastered with a **predefined methodology** to solve more **complex but recurring and precisely specified problems.**"²

² <https://ki.fhws.de/thematik/starke-vs-schwache-ki-eine-definition/>

Key question: What recurring and precisely specifiable problems are there in education?

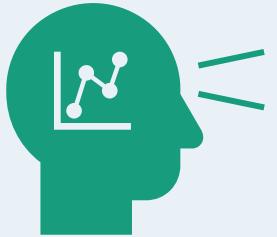
How could education be optimized with an infinite number of staff?



* Altun, Daniela; Krauss, Christopher; Streicher, Alexander; Müller, Christoph; Atorf, Daniel, Rerhaye, Lisa; Kunde, Dietmar. Lessons learned from creating, implementing and evaluating assisted e-learning incorporating Adaptivity, Recommendations and Learning Analytics. In: Sotilare, R.A., Schwarz, J. (eds) Adaptive Instructional Systems. 24rd International Conference on Human-Computer Interaction (HCII 2022), Session: On the Efficacy and Usability of Adaptive Instructional Systems, volume 32, 26 June – 1 July 2022. Lecture Notes in Computer Science, vol 13332. Springer, Cham. https://doi.org/10.1007/978-3-031-05887-5_18

Motivation

What does AI have to do with education?



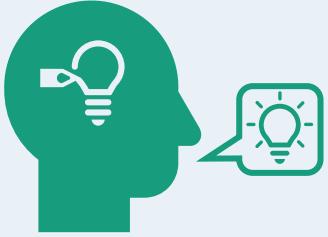
AI
analyzes



AI
evaluates



AI
reacts



AI
generates

Some Examples:

Determination of Knowledge Levels	<i>Learning Recommendations</i>	Generation of Learning Content
Educational Data Mining		
Learning Analytics	<i>Learning Need Prediction</i>	Q&A Chatbots
<i>Identification of Competencies</i>		Exam Generation
<i>Learning Records Analysis</i>	Exercise & Exam Evaluation	<i>Virtual Learning Assistants</i>
Analysis of typical learning patterns		LLM-based Chatbots
	<i>Semantic Search</i>	<i>Image Generation</i>

SPONSORED BY THE

Requirements in implementing AI in education

1) Methodological requirements:

- Think about the mission/ problem statement and how can the success of AI be measured? (Altun et. al, 2022)
- The goal, the methodology and the evaluation framework must be tailored to each other (Krauss et. Al, 2019)

2) Organizational requirements:

- Identify stakeholders, take them seriously, let them influence and train them (Ifenthaler & Drachsler, 2020)
- Initiate or establish processes (Flanagan and Ogata, 2017)

3) Didactic requirements:

- AI does not replace humans but should assist with certain tasks (Chaudhry & Kazim, 2021)
- AI functions must be embedded in the didactic setting (Ciolacu et. Al, 2018)

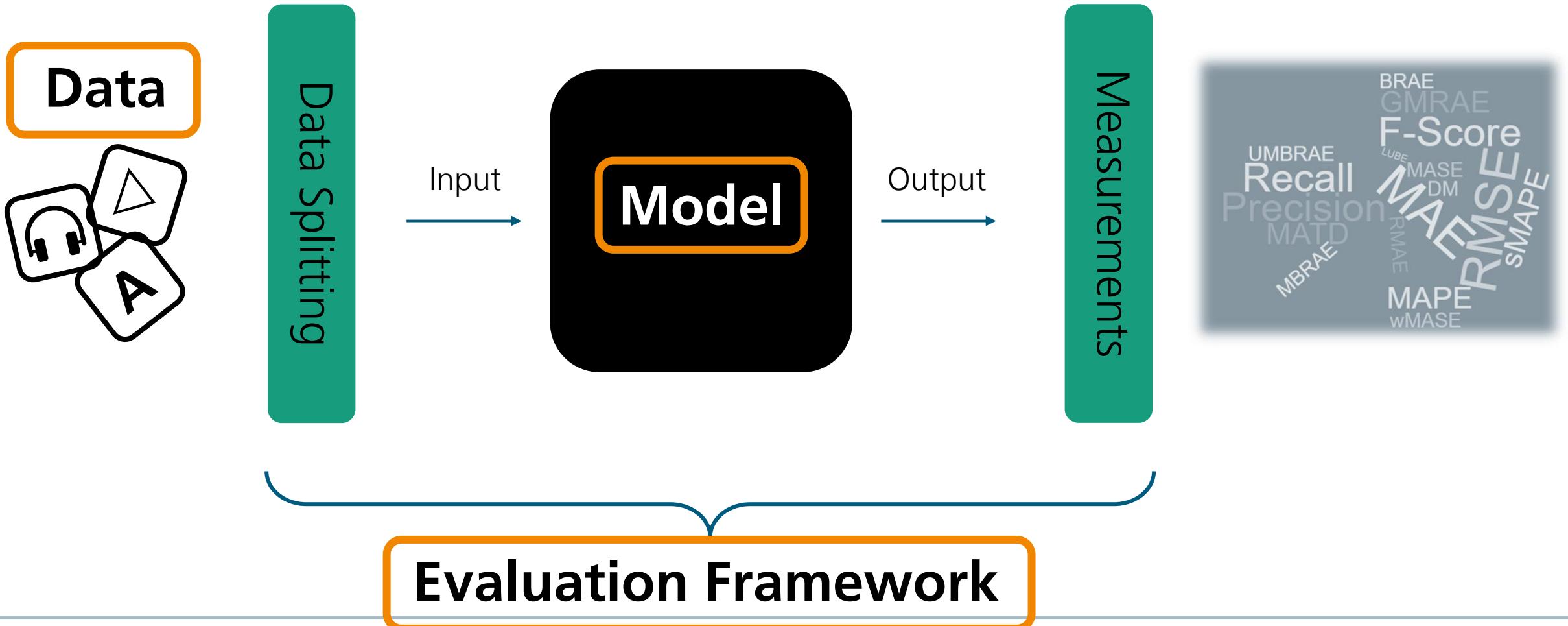
4) Content requirements:

- Appealing and multifaceted digital media must be available, well described by metadata, and interoperably usable

5) Technical requirements:

- Ideally, integrate data and services based on open interoperability standards (Ifenthaler & Drachsler, 2020)

How to evaluate AI components?



A good Evaluation-Framework? – Methodological Questions:

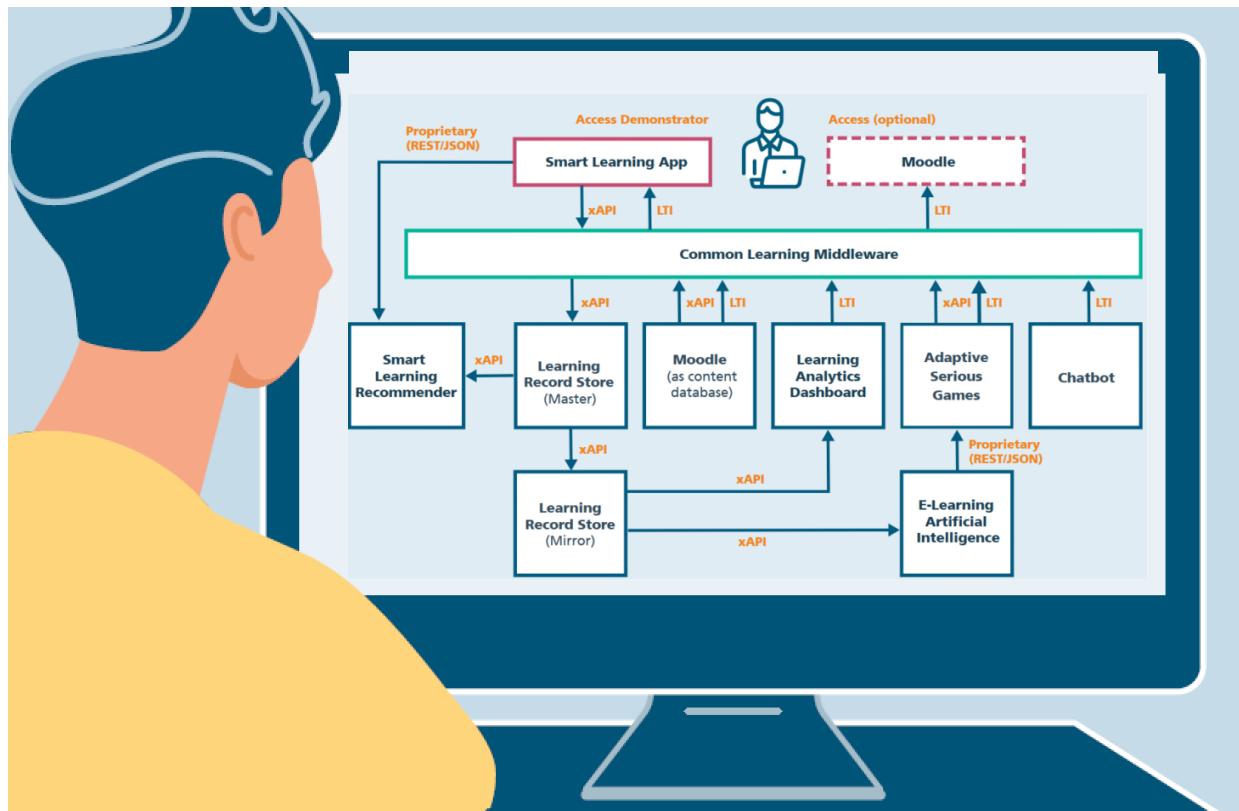
In advance, define and describe well:

1. Model: *What is **the problem and the goal** of the approaches/ objects of investigation?*
2. Data: *Which **data set** is used as input and how is the data set structured?*
3. Evaluation Framework: *How are **training and test data** split?*
4. Evaluation Framework: *What **cross-validation method** is used?*
5. Evaluation Framework: *What **metrics** are used to prove whether an approach works “adequately”?*

Can the results be compared with other approaches?

Reference Project

Bundeswehr: KI in LMS



Fraunhofer
FOKUS

Fraunhofer
FKIE

Fraunhofer
IOSB



Bundeswehrstudie "KI-Unterstützung
für Lernmanagementsysteme":

<https://kilms.fraunhofer.de>



KI in LMS

Künstliche Intelligenz in Lernmanagementsystemen

Studie durchgeführt von:



Im Auftrag:



Bundeswehr

The special educational paradigm for recommendations

Learning recommendation systems should be based on **knowledge levels**

Identification of **learning needs**
instead of preferences

Levels of **knowledge change faster**
over time than preferences

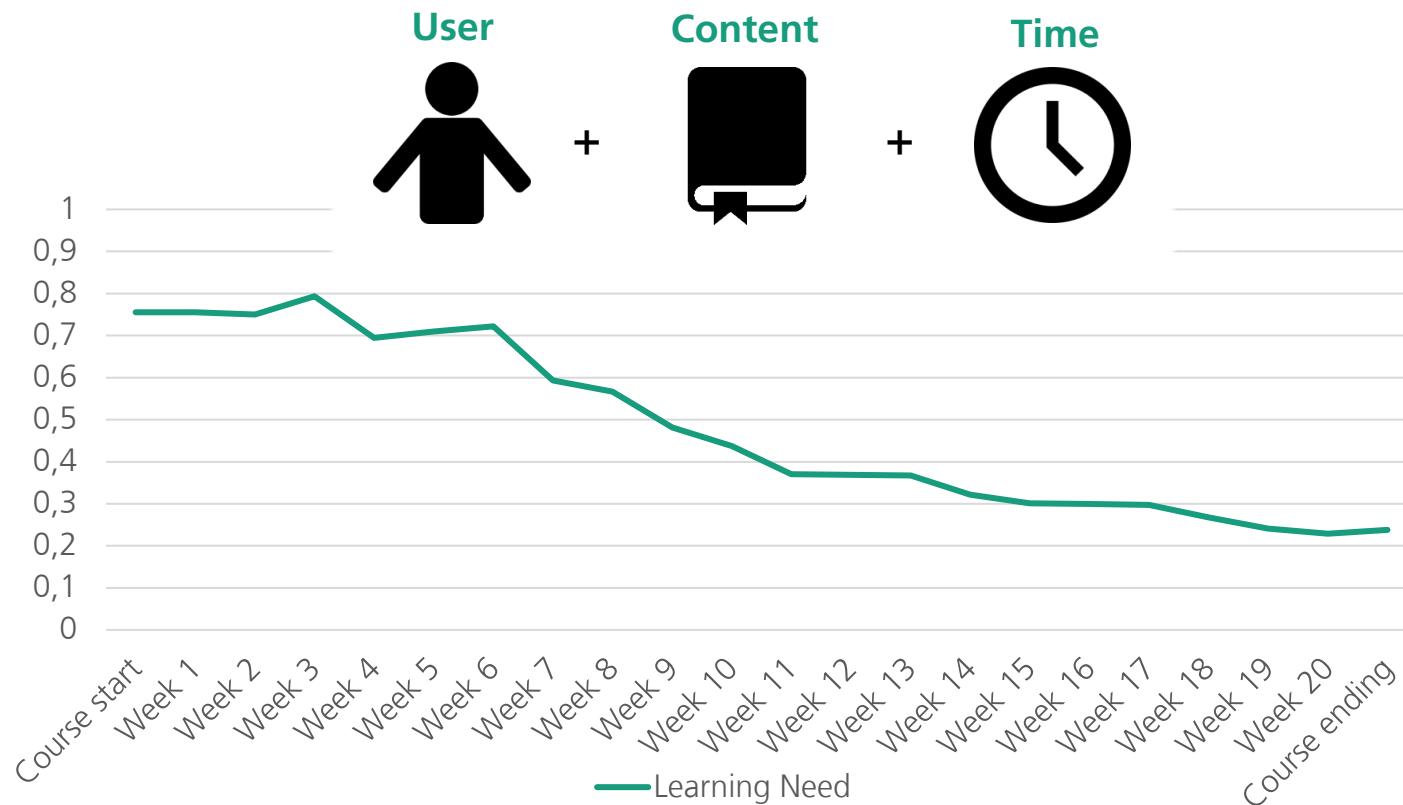
Transfer of **successful learning behavior**
instead of similar behavior from others



* Krauss, Christopher; Merceron, Agathe; Arbanowski, Stefan. Smart Learning Object Recommendations based on Time-Dependent Learning Need Models. In Proceedings of The 12th International Conference on Educational Data Mining (EDM 2019), Michel Desmarais, Collin F. Lynch, Agathe Merceron, & Roger Nkambou (eds.), pp. 599 - 602, July 2 – 5, 2019, Montréal, Canada.

Learning Recommender Systems

Model: Weighted time-based learning needs



Diese Themen solltest du als
nächstes lernen ⓘ

Solare Kühlung

Öffnen
Statistik

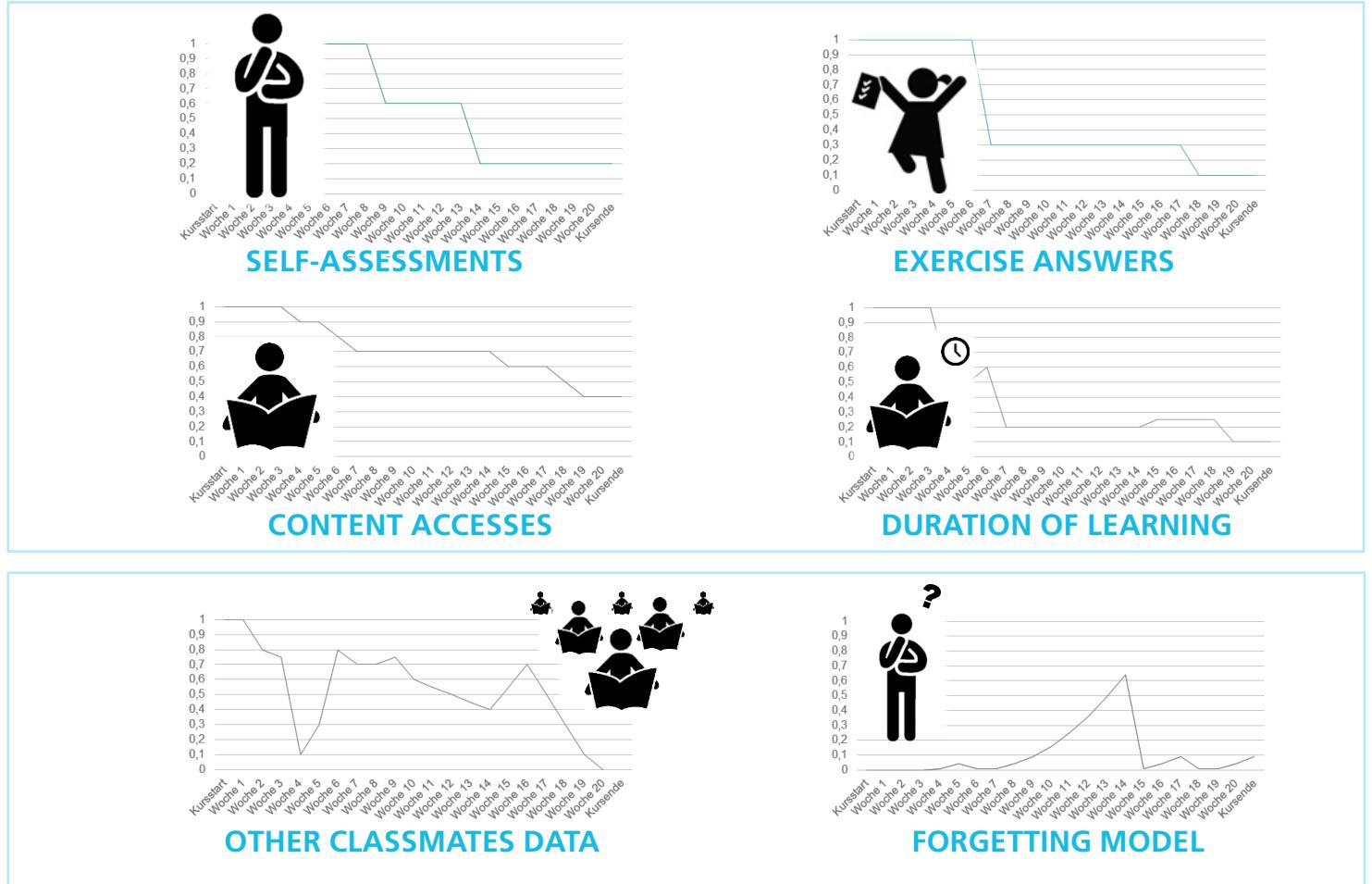
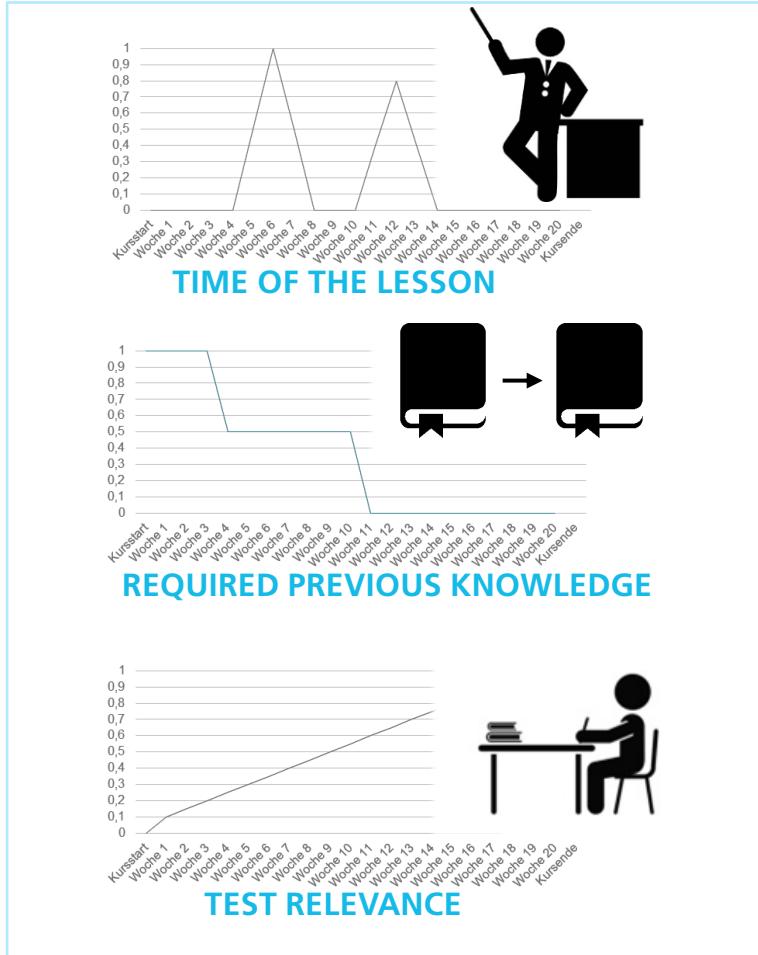
Lernfortschritt: 17%
Angesehen: 13%

Selbsteinschätzung

* Krauss, Christopher; Merceron, Agathe; Arbanowski, Stefan. Smart Learning Object Recommendations based on Time-Dependent Learning Need Models. In Proceedings of The 12th International Conference on Educational Data Mining (EDM 2019), Michel Desmarais, Collin F. Lynch, Agathe Merceron, & Roger Nkambou (eds.), pp. 599 - 602, July 2 – 5, 2019, Montréal, Canada.

Learning Recommender Systems

Data analyses based on LOM, xAPI and co.



* Krauss, Christopher; Merceron, Agathe; Arbanowski, Stefan. Smart Learning Object Recommendations based on Time-Dependent Learning Need Models. In Proceedings of The 12th International Conference on Educational Data Mining (EDM 2019), Michel Desmarais, Collin F. Lynch, Agathe Merceron, & Roger Nkambou (eds.), pp. 599 - 602, July 2 – 5, 2019, Montréal, Canada.

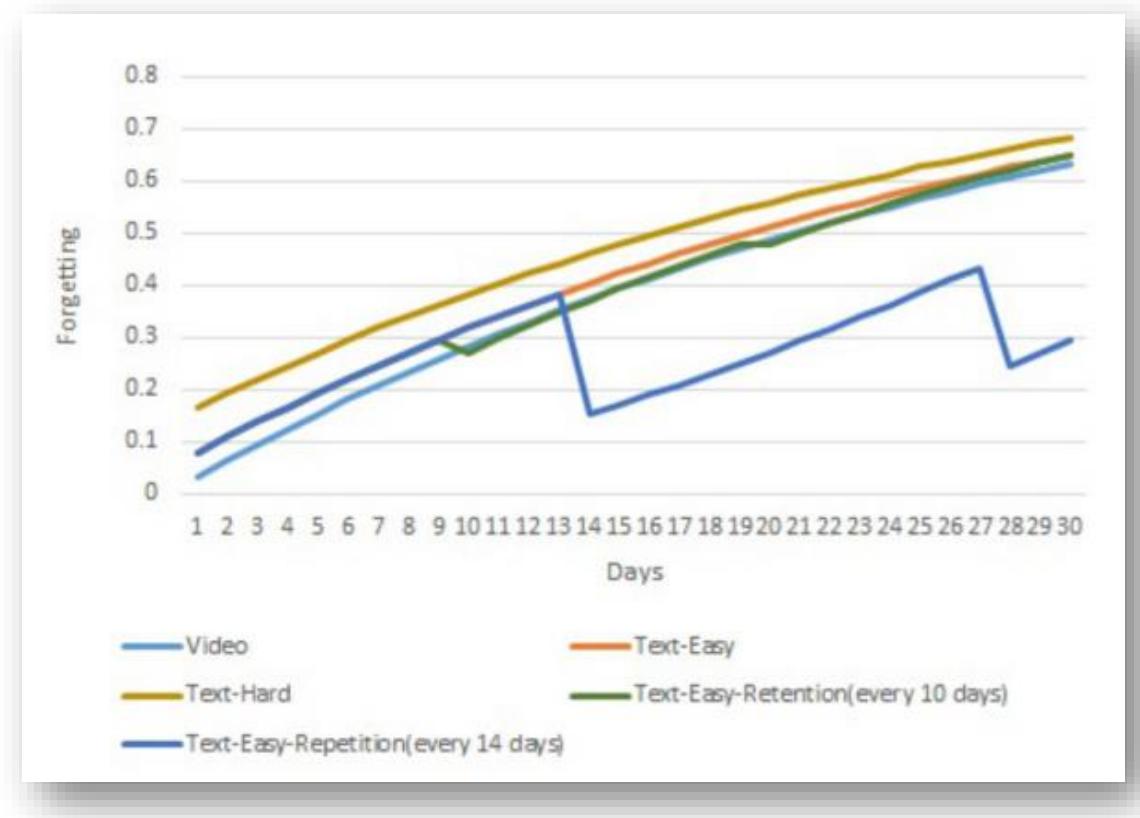
Learning need factor: Forgetting effect

$$rf_{u,i,forgetting}(t) = factorEffect(t) + \alpha$$

The model includes two main parameters: the *factorEffect* with respect to learning times and media metadata as well as a personalized parameter α that customizes the forgetting equation for the learner and thus, represents the individual forgetting process. The value of forgetting is restricted between 0 and 1 as well as all the other factors. The *factorEffect(t)* corresponds to the following exponential function:

$$factorEffect(t) = 1 - e^{-(timeFactor(t) - E_{rep} - E_{ret} + E_m + E_d)}$$

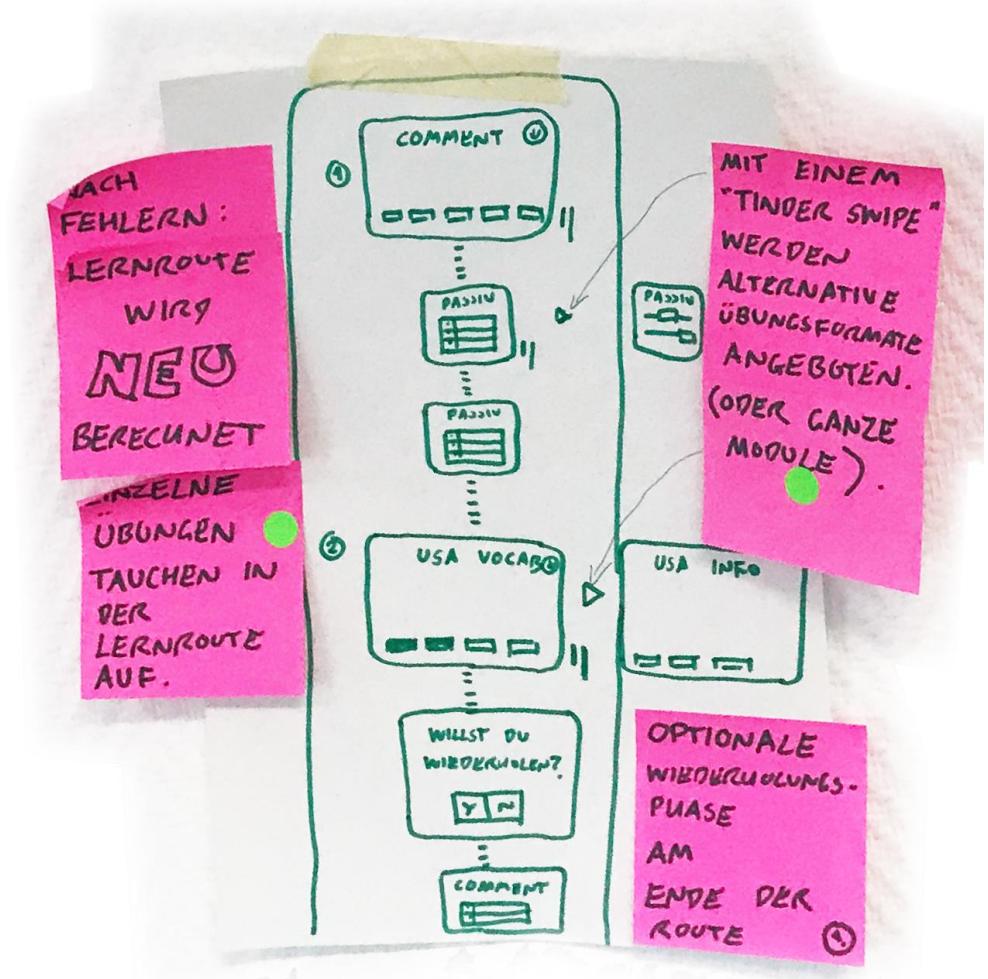
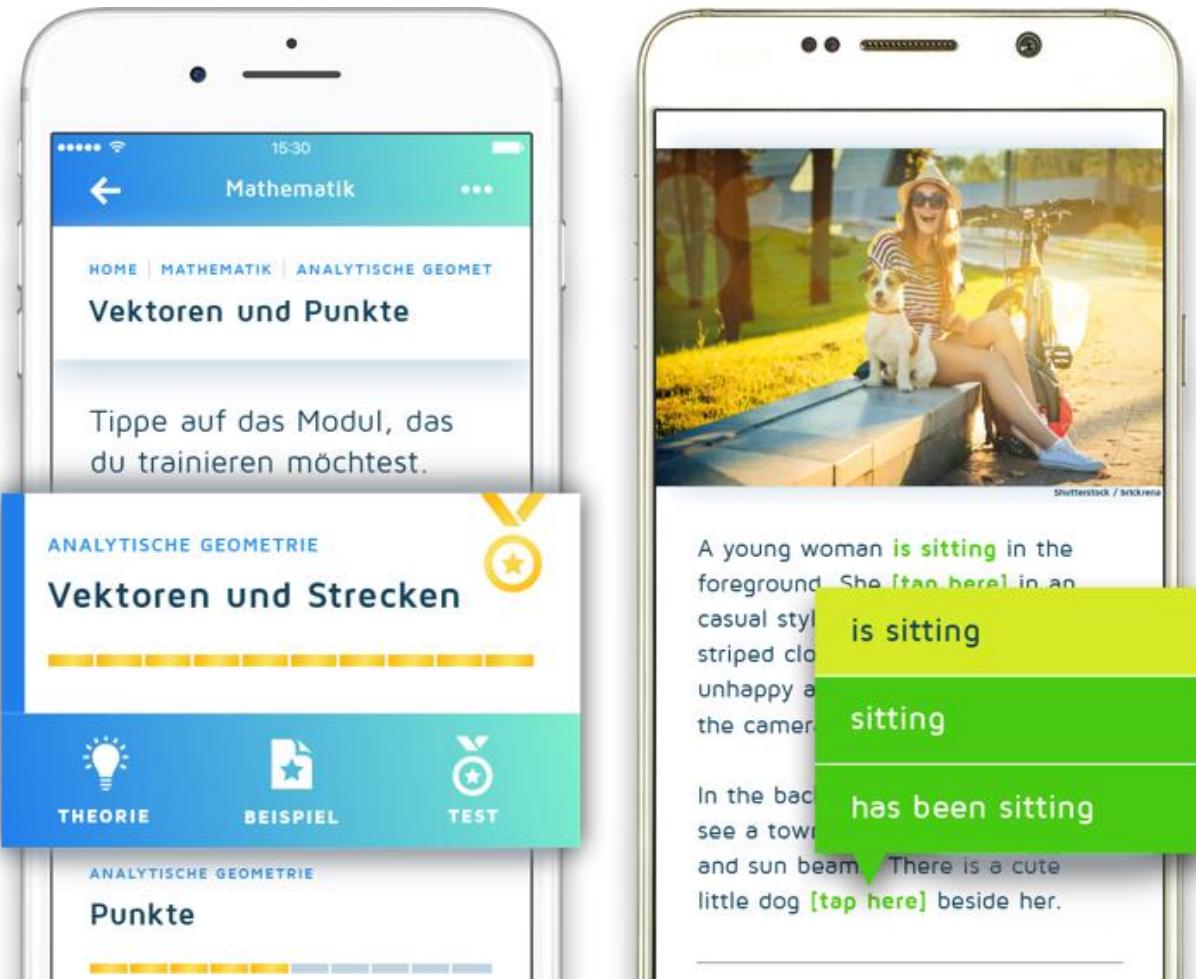
Thereby, the e-function shows the most similar progress compared to the participants forgetting in the survey and a set of parameters represent the exponent. Where E_{rep} is the repetition effect, E_{ret} is the retention test effect, E_m is the media type effect and E_d represents the difficulty level. If the learner does not repeat to learn a learning object or does not answer retention tests, these parameters are set to 0.



* Krauss, Christopher; Merceron, Agathe; Arbanowski, Stefan. Smart Learning Object Recommendations based on Time-Dependent Learning Need Models. In Proceedings of The 12th International Conference on Educational Data Mining (EDM 2019), Michel Desmarais, Collin F. Lynch, Agathe Merceron, & Roger Nkambou (eds.), pp. 599 - 602, July 2 – 5, 2019, Montréal, Canada.

Learning Paths

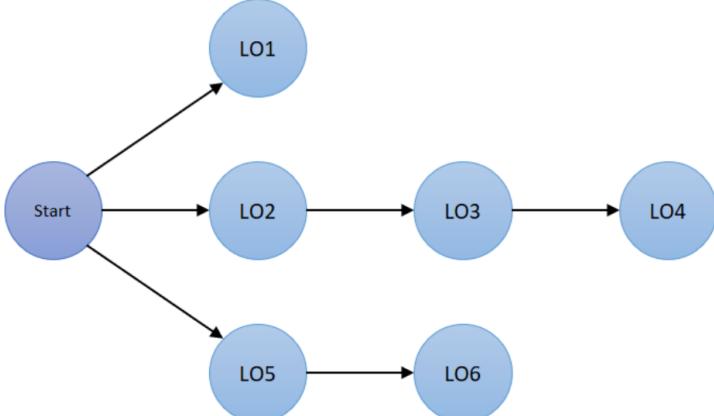
Cornelsen Clevery App



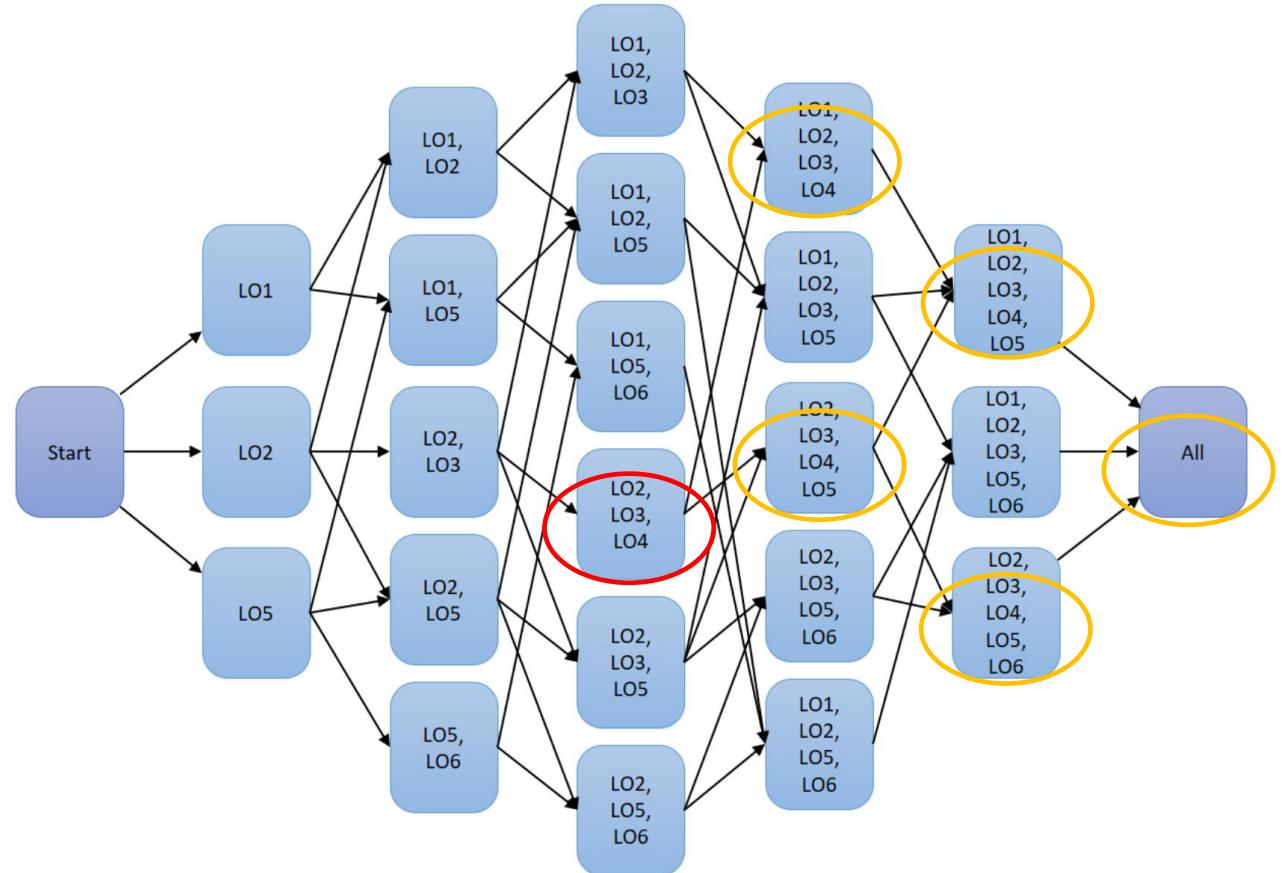
Learning Paths

Recommendations for personal learning paths

1) Dependency Graph



2) Knowledge Graph

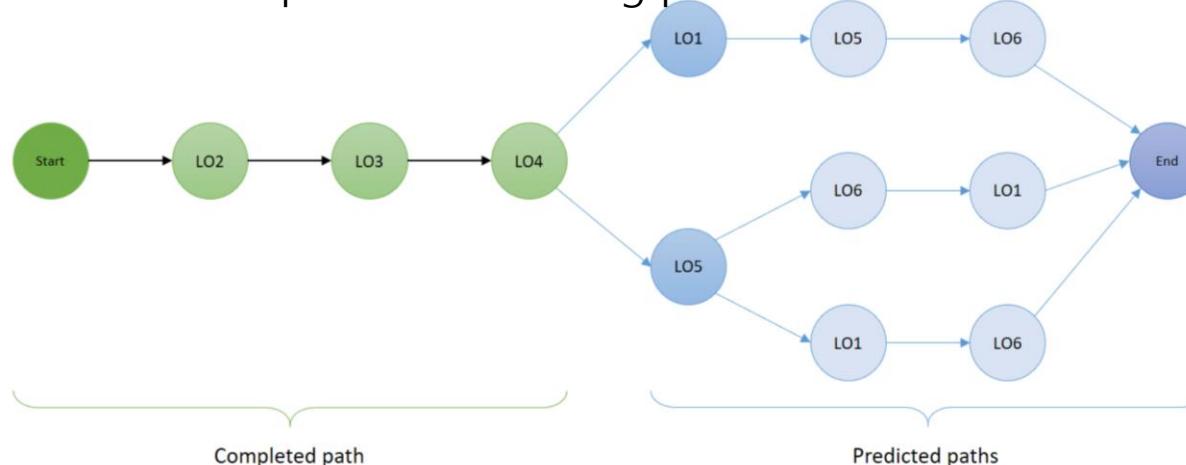


Recommendations for personal learning paths

3) Determination of the most suitable path on the basis of

- Teacher specifications (didactic sequences)
- Content analysis
- Fulfillment of preconditions and exclusion criteria
- Knowledge-based approaches
- Activity-based approaches
- Hybrid combinations

4) Presentation of personal learning paths:



* Krauss, Christopher; Salzmann, Andreas; Merceron, Agathe. Branched Learning Paths for the Recommendation of Personalized Sequences of Course Items. In: Daniel Schiffner (Hrsg.) u.a.; Gesellschaft für Informatik / Fachgruppe E-Learning: DeLF1 2018 - die 16. E-Learning Fachtagung Informatik der Fachgruppe E-Learning der Gesellschaft für Informatik e.V. : 10.-12. September 2018 Frankfurt, Deutschland. Bonn: Ges. für Informatik, 2018. http://ceur-ws.org/Vol-2250/WS_LA_paper5.pdf

Virtual Learning Assistent

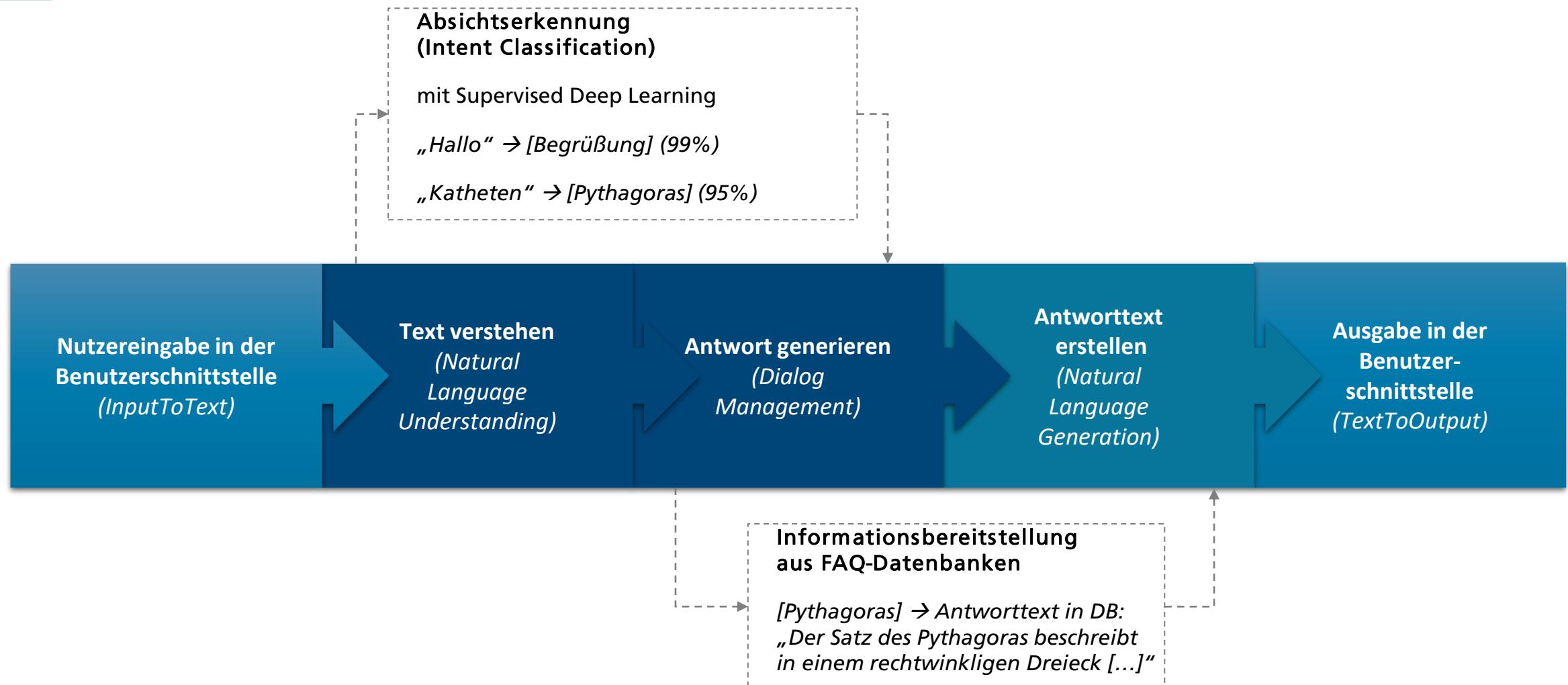
The screenshot shows a web-based chat interface titled "LERNASSISTENT". On the left is a sidebar with the "SMART LEARNING" logo and several menu items: "Willkommen", "Lernempfehlungen", "Virtueller Lernassistent" (which is highlighted in blue), "Adaptive Aufgaben", "Lernauswertung", "Lösen von Gleichungen mit einer Variablen", and "Gleichungen mit mehreren Variablen". The main area is titled "BW Chatbot". A message from the bot says: "Ich bin ein Chatbot, erstellt mit dem Ziel, häufig gestellte Fragen leicht verständlich zu beantworten. Bitte habe noch etwas Nachsicht mit mir. Da ich zum ersten Mal in der Pionierschule eingesetzt werden, weiß ich noch nicht genau, was die wirklich wichtigsten Fragen sind. Aber auch, wenn ich deine Fragen mal nicht beantworten kann, helfen mir diese, mich auf zukünftige Einsätze besser vorzubereiten." A user message "Wer bist du" is timestamped at 22:41. The bot responds with "Wie lautet der Satz des Pythagoras?" timestamped at 22:41. A user message "Der Satz des Pythagoras beschreibt in einem rechtwinkligen Dreieck einen mathematischen Zusammenhang zwischen der Hypotenuse "c" und den Katheten "a" und "b" bei dem gilt: $a^2 + b^2 = c^2$ " is timestamped at 22:41. At the bottom is a text input field with "type a message..." and a send button.

Aus der Bundeswehrstudie "KI-Unterstützung für Lernmanagementsysteme": <https://kilms.fraunhofer.de> (2020 – 2021)



Aus dem Smart Learning Projekt (BMBF gefördert 2014-2018)

How classic chatbots work: FAQ- and Form-Chatbots



Chatbots & LLMs

ChatGPT

ChatGPT Sprints to One Million Users

Time it took for selected online services to reach one million users



* one million backers ** one million nights booked *** one million downloads
Source: Company announcements via Business Insider/LinkedIn



statista

<https://www.statista.com/chart/29174/time-to-one-million-users/>

GPT, DALL-E, COPILOT

Microsoft soll mit 10 Milliarden bei OpenAI einsteigen

Die tiefe Integration der Dienste des KI-Start-ups OpenAI will Microsoft wohl nicht mehr so leicht aus der Hand geben und investiert massiv.



10. Januar 2023, 15:06 Uhr, Sebastian Grüner

<https://www.golem.de/news/gpt-dall-e-copilot-microsoft-soll-mit-10-milliarden-bei-openai-einsteigen-2301-171089.html>

BILDUNG UND FORSCHUNG

Bundestag untersucht Auswirkungen von ChatGPT auf Bildung

Die Zukunft der Bildung und Forschung im Lichte von ChatGPT und anderen Chatbots liegt im Fokus einer neuen Studie des Bundestags.



12. Februar 2023, 16:25 Uhr, Andreas Donath

<https://www.golem.de/news/bildung-und-forschung-bundestag-untersucht-auswirkungen-von-chatgpt-auf-bildung-2302-171838.html>

Chatbots & LLMs

Fraunhofer LLM Chatbot

Hallo!
Womit kann ich Ihnen heute helfen?

You: Wie berechne ich die Hypotenuse von einem Dreieck?

Chatbot:
Um die Hypotenuse eines Rechtecks zu berechnen, kannst du die Pythagorenumformel verwenden. Das Pythagoreumformel besagt, dass in einem rechten Dreieck die Quadrat der Länge der Katheten (die beiden kürzeren Seiten) gleich dem Quadrat der Länge der Hypotenuse ist. In Formeln geschrieben lautet das: $c^2 = a^2 + b^2$, wobei c die Länge der Hypotenuse und a und b die Längen der Katheten sind. Um die Länge der Hypotenuse zu berechnen, musst du also die Quadratwurzel aus $a^2 + b^2$ berechnen.

Bitte geben Sie hier Ihre Frage ein

Abschicken

The OS LLM chatbot works in principle like ChatGPT, but with one key difference: the model used is deployed in a separate network.

Example of entries in the LLM chatbot:

You: Wie lassen sich Quantenmechanik und Relativitätstheorie innerhalb von einer Theorie vereinigen?

Chatbot:
Es gibt verschiedene Ansätze, um Quantenmechanik und Relativitätstheorie in eine einheitliche Theorie zu integrieren. Eine der bekanntesten Versuche ist die Stringtheorie. Gemäß dieser Theorie bestehen Elementarteilchen nicht aus Punkten, sondern aus kleinsten, unzerlegbaren Streifen (String), die sich in Raum und Zeit erstrecken. Die Stringtheorie versucht, sowohl die Quantenmechanik als auch die Relativitätstheorie zu vereinen, indem sie die Natur der Elementarteilchen und die Gravitation in einer einheitlichen Theorie beschreibt.

Es ist jedoch wichtig zu beachten, dass die Stringtheorie noch keinen endgültigen Konsens erreicht hat und viele offene Fragen aufwirft. Andere Ansätze zur Vereinigung der beiden Theorien sind die Theorie der allgemeinen Relativitätstheorie quantisiert (Quantengravitation) und die Theorie der Gravitationswellen.

Hallo!
Womit kann ich Ihnen heute helfen?

Bitte geben Sie hier Ihre Frage ein

Senden

PDF einfügen

Bitte geben Sie eine URL zu einer PDF Ihrer Wahl ein oder klicken sie auf: Beispiel

Bitte geben Sie hier eine URL zu einer PDF ein

Abschicken

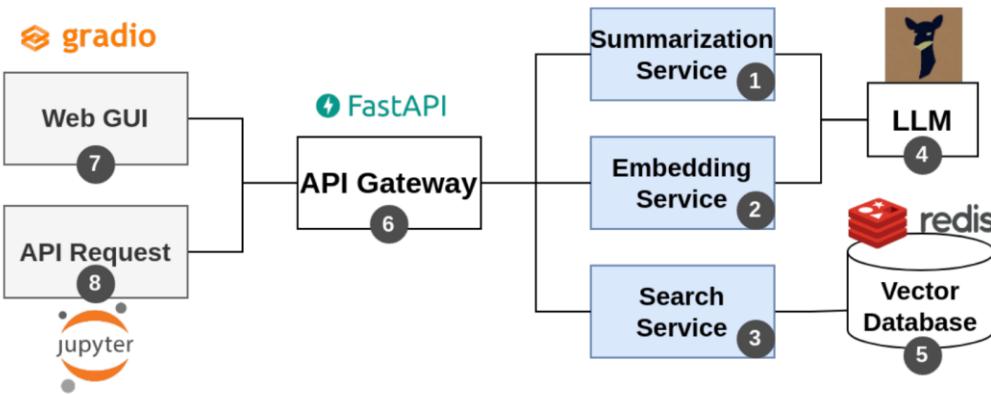
Hier klicken, um eine PDF Datei hochzuladen

[Impressum](#) | [Datenschutz](#) | [Logout](#)

New knowledge can also be added to the model in the form of documents.

Chatbots & LLMs

SkillGPT



There are two major phases of SkillGPT's lifecycle. *First* is the system initialization for embedding and storing the ESCO taxonomy, where the ESCO entries are downloaded and converted into structured documents, then their vectorized representations are computed by the backbone LLM④ via a document embedding service②, and finally stored in the vector database⑤.

Second is the main functionality of skill extraction and standardization. Extracting free-style textual skills from a job description or user resume is achieved by carefully prompting the LLM for summarization①. The embedding (via ②) of the distilled text is used as a query to retrieve the top-k similar ESCO terms via vector similarity search③. All these are coordinated by an API gateway⑥.

To perform an one-stop SES or to interact with any individual service, we provide two options: direct interaction with a RESTful API⑧, or via graphical user interface⑦ (e.g. Gradio App).

SkillGPT

A RESTful API service for skill extraction and standardization from job descriptions and user profiles using large language model

The screenshot shows the SkillGPT API interface. It consists of several panels:

- Document:** A text input field with placeholder text "Description de la fonction a". Below it is a "Document type" section with radio buttons for "job description" (selected) and "user profile".
- Summary:** A text output field with placeholder text "d". Below it is an "ESCO concept type" section with radio buttons for "skills" (selected), "occupations", and "skillGroups".
- ESCO concepts:** A table with columns: rank, preferredLabel, conceptType, code, altLabels. It lists five rows of ESCO concepts related to financial audits.
- Extract:** A button labeled "Extract" located on the right side of the interface.

Annotations with red circles and letters:

- a:** Description of the function input field.
- b:** Document type radio buttons, with "job description" selected.
- c:** "Summarize" button on the right.
- d:** Summary output text.
- e:** Description of the function output text.
- f:** ESCO concept type radio buttons, with "skills" selected.
- g:** ESCO concepts table.
- h:** "Extract" button on the right.
- i:** ESCO concepts table.
- j:** ESCO concepts table.

Competences

Triangle of competences

BERUFSERFAHRUNG

- Entwickler und Analytiker von Software und Anwendungen

ALLGEMEINE UND BERUFLICHE BILDUNG

- test Bildungseinrichtung
Test Berufliche Bildung

SPRACHKENNTNISSE

Muttersprache(n)

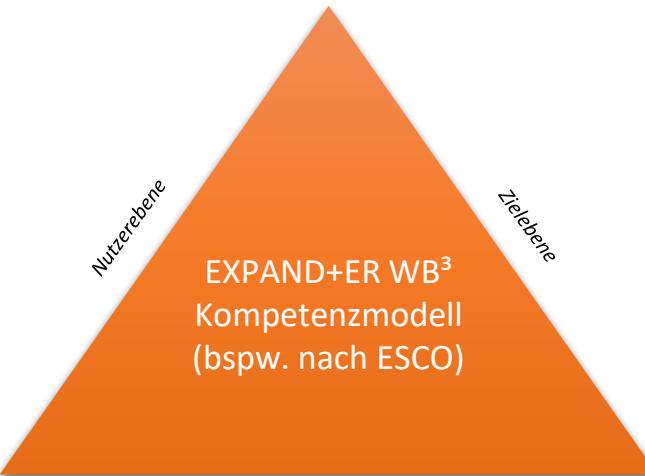
Deutsch

Weitere Sprache(n)

- Englisch
 - Hören
 - C2
 - Lesen
 - C2
 - An Gesprächen teilnehmen
 - C2

Individuelle Zielkompetenzen:
Abfrage oder Ermittlung des Bedarfs

Bedarf an Kompetenzen für Nutzer



Nachhaltigkeitsstrategie - Haushalt (Präsenzseminar)

1 Tage 395 EUR [zur Kursseite](#)

Lohnpfändung, Lohnpfändung, (Online-Seminar)

1 Tage 250 EUR [zur Kursseite](#)

Industrie- und Handelskammer Potsdam - Bildungszentrum

Lieferkettenmanagement

1 Tage 120 EUR 14467 Potsdam [sven.fischer@ihk-potsdam.de](#) [zur Kursseite](#)

Industrie- und Handelskammer Potsdam - Bildungszentrum

Sustainable Leadership (IHK)

3 Monate 2560 EUR 14467 Potsdam [kerstin.poloni@ihk-potsdam.de](#) [zur Kursseite](#)

Kompetenzprofil (auf Basis Zertifikate, Nachweise, ePortfolios)

Zielkompetenzen der Weiterbildungen (Metadaten)

Competences

Adaptive Course Recommendations

I want to become Softwareentwickler/Softwareentwicklerin
by 16/11/2024

+ ADD GOAL

-  Goals
-  Achievements
-  Profile
-  Settings

← BACK

Learning path committed at 16-11-2023 11:23:34

Anforderungsmanagement

Kompetenzen, die in diesem Kurs vermittelt werden:

technische Dokumentation bereitstellen

Softwareprototyp entwickeln

Start date: Thu Dec 07 2023

Flussdiagramm erstellen

Software-Entwurfsmuster verwenden

anwendungsspezifische Schnittstelle verwenden

technische Anforderungen definieren

Start date: Sun Dec 17 2023

Excel - Lösen komplexer Aufgabenstellungen

Kompetenzen, die in diesem Kurs vermittelt werden:

Kundenbedürfnisse ermitteln

Start date: Wed Dec 27 2023

Softwareentwickler/Softwareentwicklerin - Mockkurs

Dies ist ein Mock-Kurs, der aufgrund von fehlenden Kompetenzen in der Kursdatenbank dynamisch erstellt wurde, um Kompetenzzücker für den Zielberuf zu schließen.

Kompetenzen, die in diesem Kurs vermittelt werden:

Softwarespezifikationen analysieren

Start date: Sat Jan 06 2024

Linux - Problemlösung

Kompetenzen, die in diesem Kurs vermittelt werden:

Softwareprobleme identifizieren und beheben

Start date: Tue Jan 16 2024

Master-Studiengang Medieninformatik (M.Sc.)

Kompetenzen, die in diesem Kurs vermittelt werden:

IKT-Debugging-Werkzeuge

Start date: Fri Jan 26 2024

Jira - Projektmanagement mit Jira BigPicture

Kompetenzen, die in diesem Kurs vermittelt werden:



Hallo fame, du hast folgende Skills erworben:

Lasst uns weiter lernen und wachsen.

JavaScript

Python (Computerprogrammierung)

Java (Computerprogrammierung)

Originalzeichnungen anfertigen

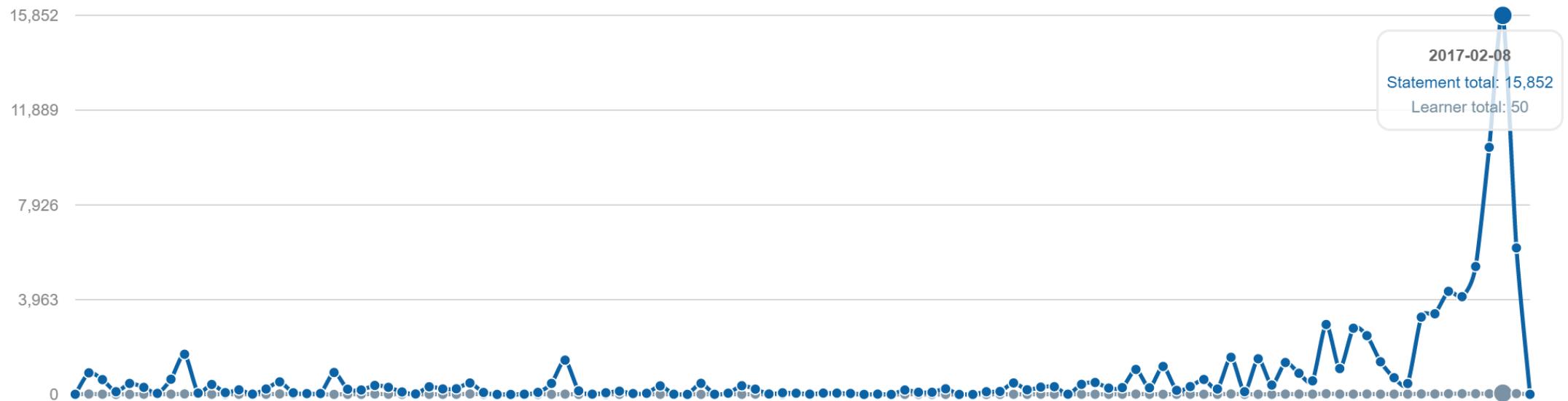
dreidimensionales Vorstellungsvermögen zeigen

Auszeichnungssprachen verwenden

Verfahren zur automatisierten Migration entwickeln

Softwarebibliotheken verwenden

- 9 topics, 14 lectures, 106 sub-topics, 1006 learning objects
- 99 active students (83 wrote the test)
- > 100.000 activity statements

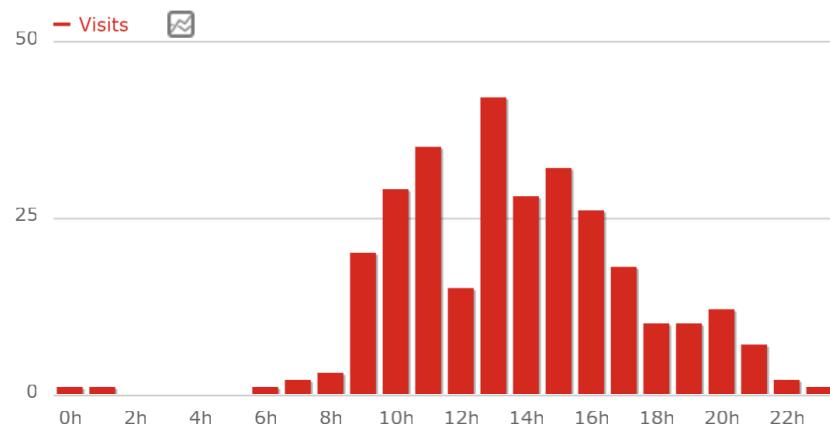


* An, Truong-Sinh; Krauss, Christopher; Merceron, Agathe. Can Typical Behaviors Identified in MOOCs be Discovered in Other Courses?. In: Proceedings of The 10th International Conference on Educational Data Mining (EDM 2017), 25 - 28 June 2017, Wuhan, China. http://educationaldatamining.org/EDM2017/proc_files/papers/paper_58.pdf

Craftsmen Vs. Computer Science

Energy Consultants @ Chamber of Crafts Berlin

Visits per local time

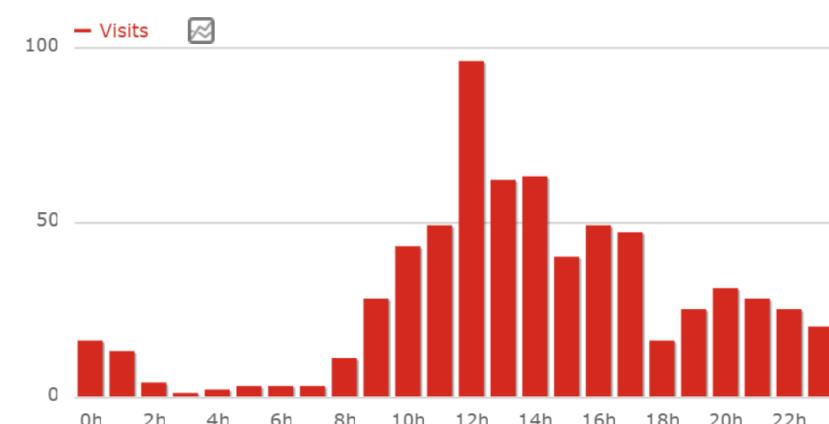


Device type

TYPE	▼ VISITS
Desktop	59.1% 240
Smartphone	24.4% 99
Tablet	16.3% 66

Computer Science Students @ TU Berlin

Visits per local time

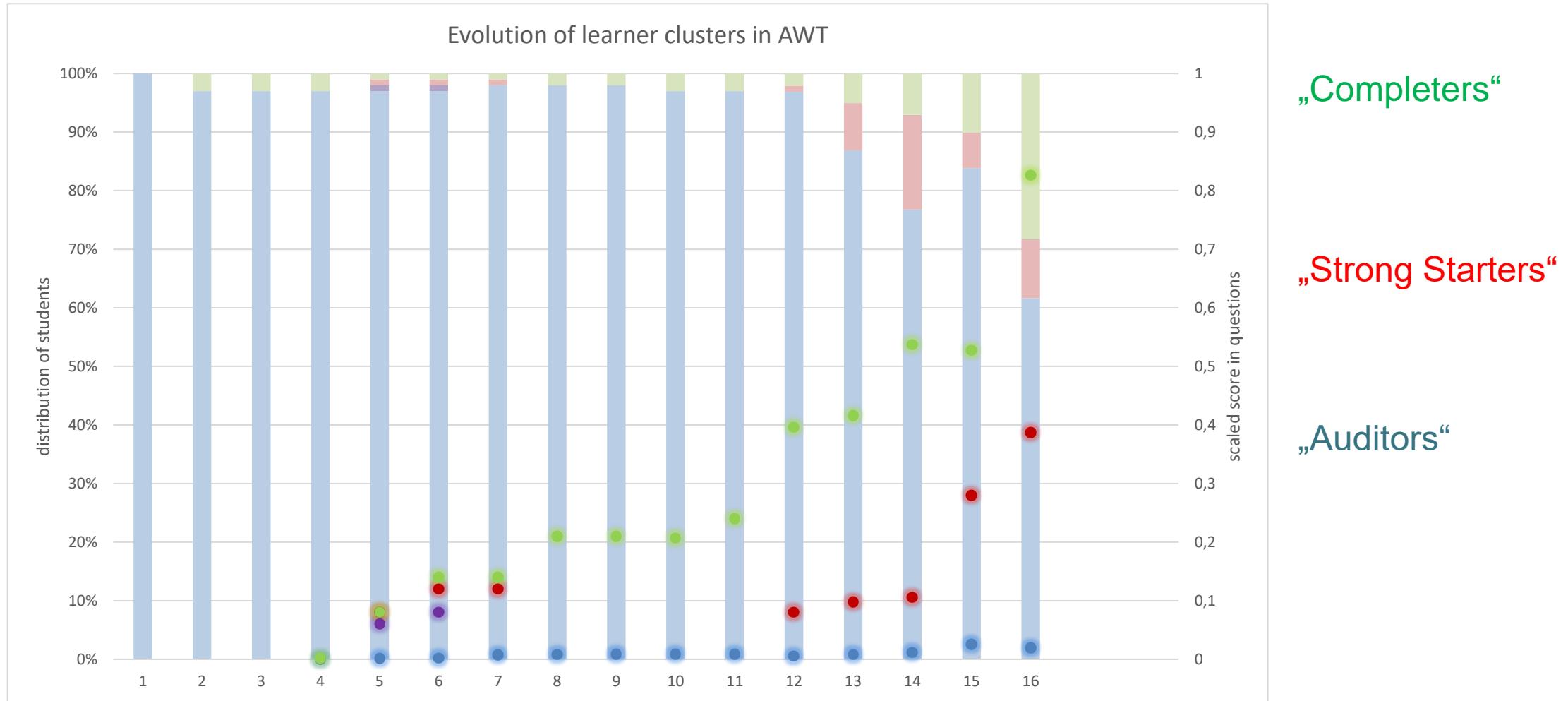


Device type

TYPE	▼ VISITS
Desktop	84.2% 591
Smartphone	11.1% 78
Tablet	3.8% 27

* An, Truong-Sinh; Krauss, Christopher; Merceron, Agathe. Can Typical Behaviors Identified in MOOCs be Discovered in Other Courses?. In: Proceedings of The 10th International Conference on Educational Data Mining (EDM 2017), 25 - 28 June 2017, Wuhan, China. http://educationaldatamining.org/EDM2017/proc_files/papers/paper_58.pdf

Typical Learning Patterns in a Semester



* An, Truong-Sinh; Krauss, Christopher; Merceron, Agathe. Can Typical Behaviors Identified in MOOCs be Discovered in Other Courses?. In: Proceedings of The 10th International Conference on Educational Data Mining (EDM 2017), 25 - 28 June 2017, Wuhan, China. http://educationaldatamining.org/EDM2017/proc_files/papers/paper_58.pdf

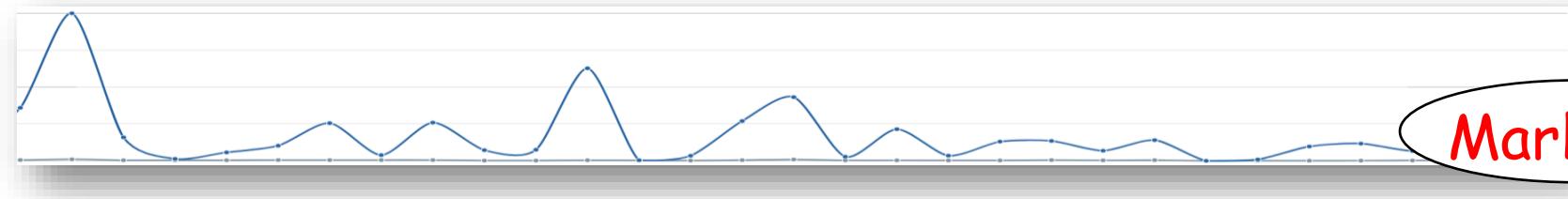
Typical Learning Patterns

Smart Learning @ AWT18/19

Average mark: 1.90 (83 exam participants)

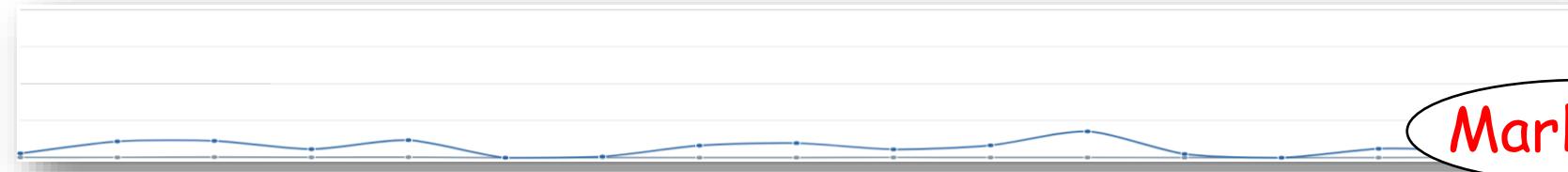
„Strong Starters“

9 students



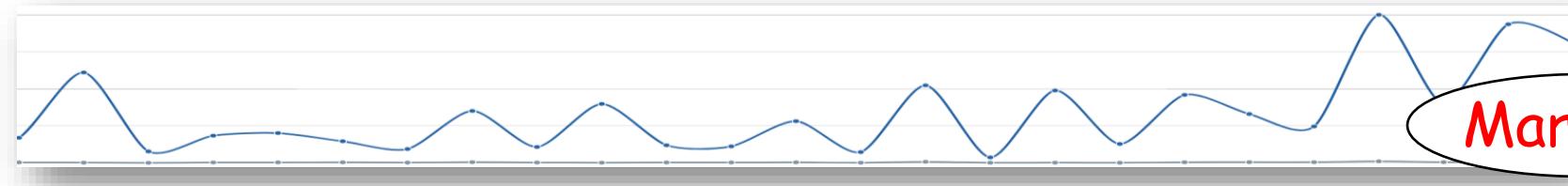
„Auditors“

64 students (incl.
the 16 drop-outs)



„Completers“

26 students



* An, Truong-Sinh; Krauss, Christopher; Merceron, Agathe. Can Typical Behaviors Identified in MOOCs be Discovered in Other Courses?. In: Proceedings of The 10th International Conference on Educational Data Mining (EDM 2017), 25 - 28 June 2017, Wuhan, China. http://educationaldatamining.org/EDM2017/proc_files/papers/paper_58.pdf



Summary

7 Golden Rules for adaptive Systems

- 1. Transparency:** Explain how the system works
- 2. Adjustment:** Allow users to tell the system it is wrong
- 3. Trust:** Increase users' confidence in the system
- 4. Effectiveness:** Help users make good decisions
- 5. Persuasiveness:** Convince users to try
- 6. Efficiency:** Help users make decisions faster
- 7. Satisfaction:** Increase the ease of usability or enjoyment



Key Findings for the Design of AI-supported learning platform

The more complex an AI-supported System, the more suitable the **Best-of-Breed Strategy!**

However, **requirements for (AI-)Services** must be well formulated and monitored.

Standardized Interfaces and Data Formats make content and data **reusable!**

A **Middleware** helps to manage data flows and might also translate between Standards!

Contact

Media & Data Science Lead

Dr. Christopher Krauss

christopher.krauss@fokus.fraunhofer.de

Fraunhofer FOKUS

Institute for Open Communication Systems

Kaiserin-Augusta-Allee 31

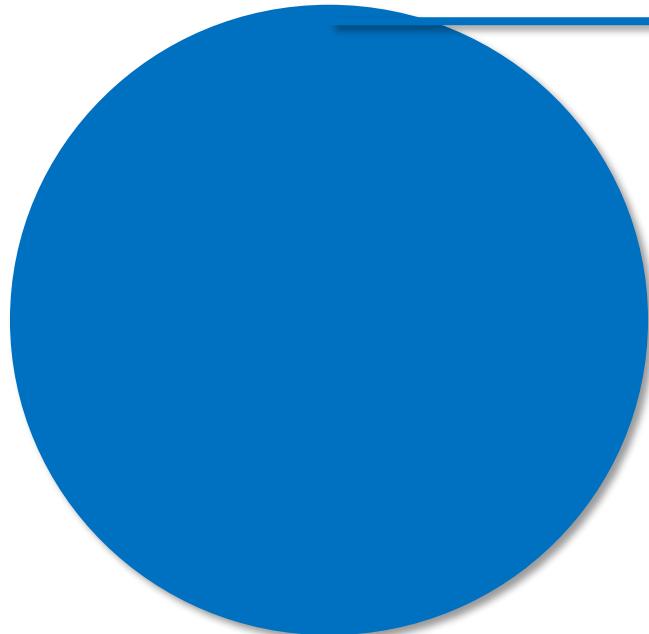
10589 Berlin, Germany

info@fokus.fraunhofer.de

www.fokus.fraunhofer.de

Intro to the Basic Concepts of Artificial Intelligence

Machine Learning – Eine Einordnung



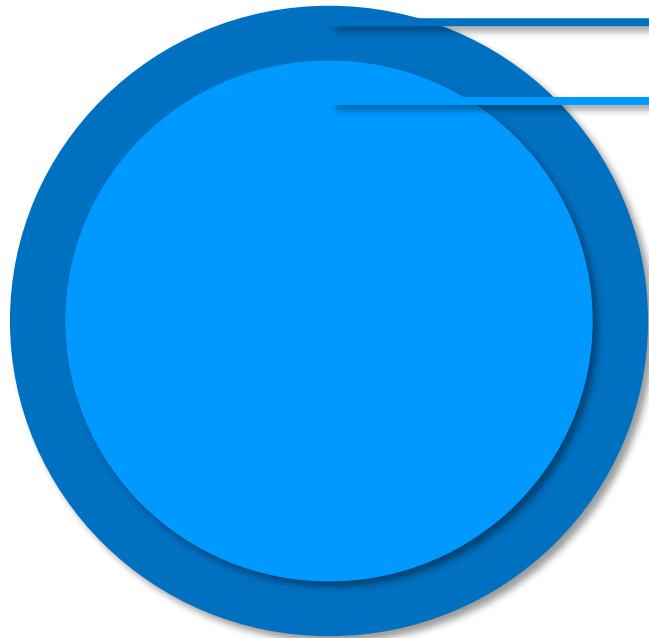
Künstliche Intelligenz



Computersysteme erledigen Aufgaben, die normalerweise **menschliche Intelligenz** erfordert hätte.

Oder sie **imitieren intelligentes menschliches Verhalten**.

Machine Learning – Eine Einordnung



Künstliche Intelligenz

↳ **Machine Learning**

👉 *KI-Systeme, die ihr Verhalten durch **regelmäßige Zuführung von Daten verbessern**.*

Machine Learning – Eine Einordnung



Künstliche Intelligenz

↳ Machine Learning

↳ **Supervised Learning**



Ähnlich wie bei einem **Schüler-Lehrer-Verhältnis**:

Die **erwarteten Antworten** werden dem ML-System
zum Trainieren vorgegeben.

Machine Learning – Eine Einordnung



Künstliche Intelligenz

↳ Machine Learning

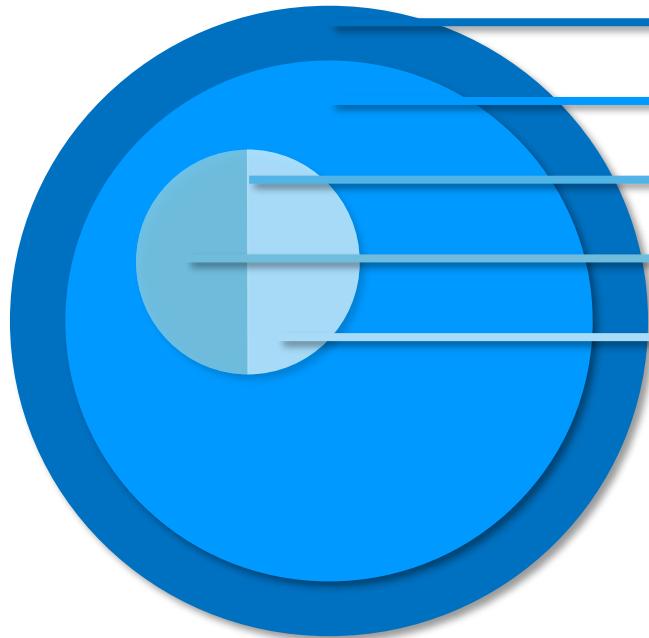
↳ Supervised Learning

↳ **Classification**



Die erwartete Antwort ist ein **Label**.

Machine Learning – Eine Einordnung



Künstliche Intelligenz

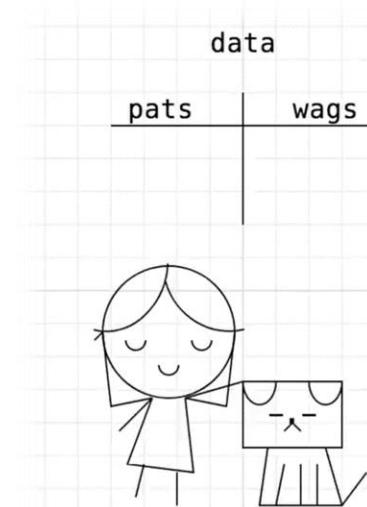
↳ Machine Learning

↳ Supervised Learning

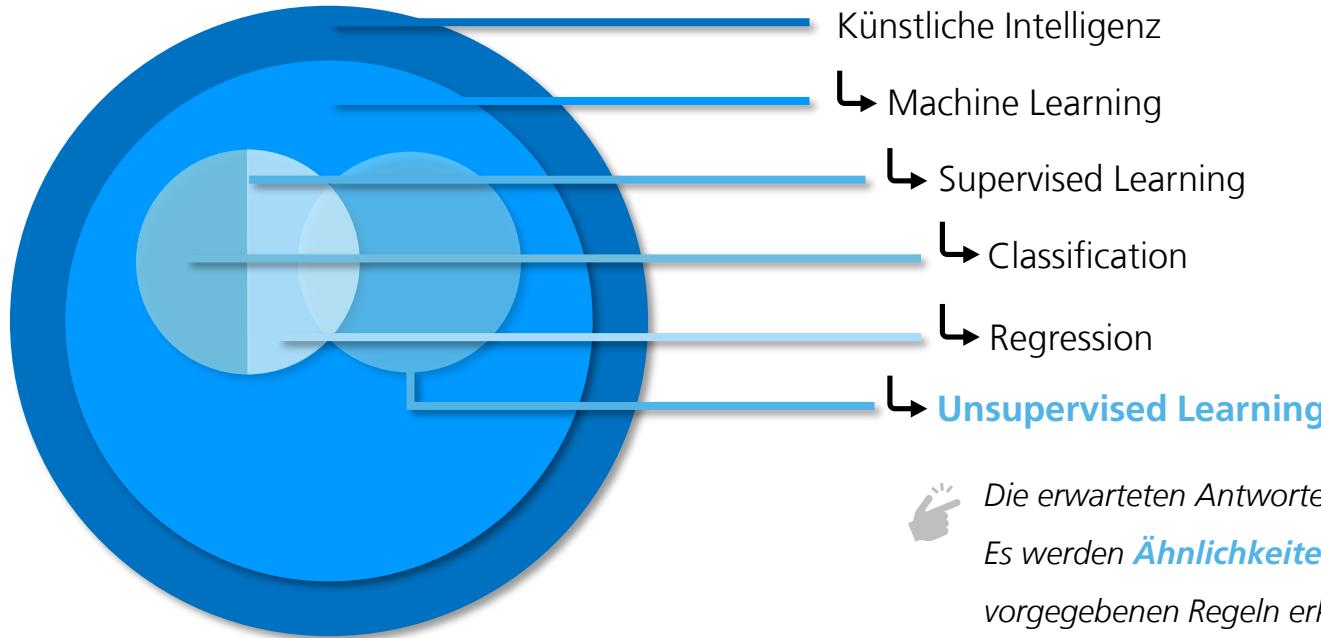
↳ Classification

↳ Regression

☞ Die erwartete
Antwort ist ein
numerischer
Wert.



Machine Learning – Eine Einordnung



Die erwarteten Antworten werden nicht vorgegeben:
Es werden **Ähnlichkeiten in den Daten** nach
vorgegebenen Regeln erkannt.

Machine Learning – Eine Einordnung

