

Human-in-the-Loop as Learning Space Design:

Piloting AI Learning Agents

Jonas Schug, M.A.

Research Associate, DigiTeach Institute
Bochum University of Applied Sciences
jonas.schug@hs-bochum.de

Teaching and Learning with AI in Europe

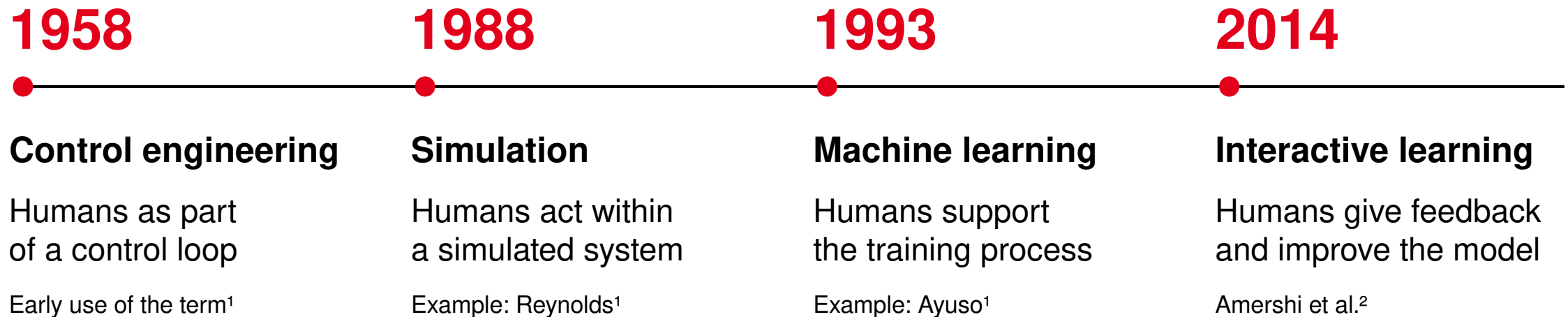
Breda University of Applied Sciences, Netherlands · 19–20 October 2026

You have used AI to create teaching material.

**Do you need to review it before
sharing it with your students?**

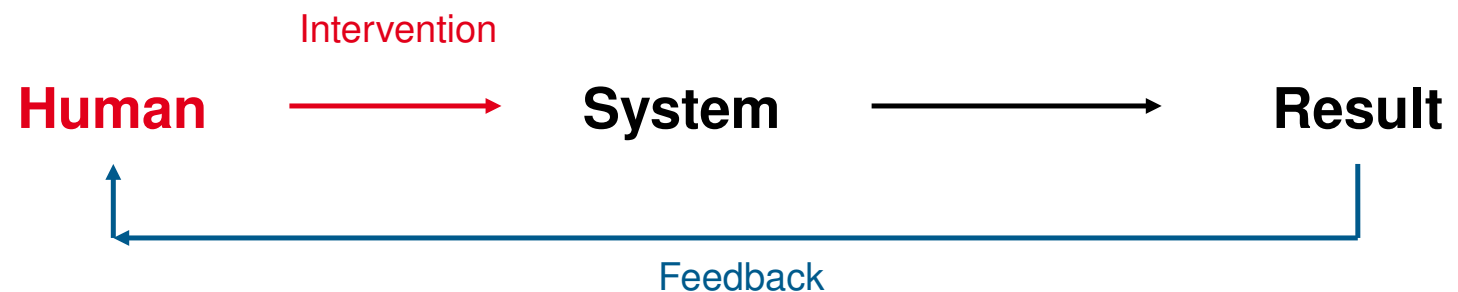
Human-in-the-Loop

Humans participate in a process and influence how it unfolds.



Core principle

Intervention and feedback



¹ Anderson & Fort (2022), pp. 3–4. ² Amershi et al. (2014). Selected examples; timeline not to scale.

AI guidelines

University of Amsterdam

GenAI in education · 2025
PDF p. 7 / printed p. 6

Within the context of the degree programme, lecturers are ultimately responsible for the content and quality of their teaching, also if they use GenAI to prepare for teaching activities. See also the point below: a critical attitude towards output is essential.

Bochum University of Applied Sciences

DigiTeach Institute
AI guidelines for teaching staff · p. 11

Grundsätzlich kann KI zur Erstellung und Überarbeitung von Lehrmaterialien eingesetzt werden. Lehrende bleiben dabei vollständig verantwortlich für Inhalt, Qualität, Didaktik, Barrierefreiheit und Rechtskonformität.

ETH Zurich

Teaching & Learning Guidelines
December 2024 · p. 1

Responsibility: As a lecturer you are responsible for the content you provide to your students. This means that teaching materials created with GenAI must be subjected to quality control by you, including checking for possible bias.

Maastricht University

AI use in professional contexts
September 2023 · p. 1

The responsibility for the use of the output of any generative AI, including LLMs, always lies with you, the user.

University of Cologne

Faculty of Arts and Humanities
Guidelines of 13 May 2026 · p. 5

Der Output einer KI-Anwendung muss von den Verwender*innen auf inhaltliche Richtigkeit, etwaige Biases, Validität und Vollständigkeit geprüft werden.

Lund University

Teaching staff and students
17 June 2026 · PDF p. 5

The individual is fully responsible for the accuracy and quality of the content, regardless of whether generative AI has been used to produce it. AI-generated material must therefore always be critically examined and verified.

A human in the loop does not guarantee control

Article

<https://doi.org/10.1038/s41562-024-02024-1>

When combinations of humans and AI are useful: A systematic review and meta-analysis

Received: 6 April 2023

Michelle Vaccaro^{1,2}, Abdullah Almaatouq¹ & Thomas Malone¹✉

Human + AI is not automatically better

Meta-analysis (106 experimental studies)

On average, human–AI teams performed below the better of human or AI alone. They still outperformed humans alone.

Results varied across tasks and contexts.

[Vaccaro, Almaatouq & Malone \(2024\)](#)

To Trust or to Think: Cognitive Forcing Functions Can Reduce Overreliance on AI in AI-assisted Decision-making

ZANA BUÇINCA, Harvard University, USA

MAJA BARBARA MALAYA, Lodz University of Technology, Poland

KRZYSZTOF Z. GAJOS, Harvard University, USA

Thinking independently reduces overreliance on AI

Experiment (199 participants)

Prompts for independent thinking reduced reliance on incorrect AI advice more than recommendations with explanations alone.

Overreliance persisted. The most effective designs received lower subjective ratings.

[Buçinca, Malaya & Gajos \(2021\)](#)

Human-in-the-loop feedback in higher education

Feasibility Study of Augmenting Teaching Assistants with AI for CS1 Programming Feedback

Umair Z. Ahmed
umair@nus.edu.sg

National University of Singapore
Singapore

Ben Leong
benleong@comp.nus.edu.sg
National University of Singapore
Singapore

Shubham Sahai
shubham@nus.edu.sg
National University of Singapore
Singapore

Amey Karkare
karkare@cse.iitk.ac.in
Indian Institute of Technology Kanpur
Kanpur, India

Review can leave AI errors uncorrected

Programming lab intervention (185 students)

Teaching assistants could edit AI feedback.
They mostly added comments, while
leaving the original AI text unchanged.

Small feedback groups; no direct learning measure.

[Ahmed et al. \(2025\), SIGCSE TS](#)

RESEARCH-ARTICLE | [OPEN ACCESS](#) | 

AI-Mediated Feedback Improves Student Revisions: A Randomized Trial with FeedbackWriter in a Large Undergraduate Course

 This article is summarized in an AI Podcast. [VIEW PODCAST](#)

Authors:  Xinyi Lu,  Kexin Phyllis Ju,  Mitchell Dudley,  Larissa Sano,  Xu Wang
[Authors Info & Claims](#)

CHI '26: Proceedings of the 2026 CHI Conference on Human Factors in Computing Systems
Article No.: 134, Pages 1 - 26 • <https://doi.org/10.1145/3772318.3791121>

Published: 13 April 2026 [Publication History](#)  Check for updates

Structured collaboration improved essay revisions

Randomized crossover trial (354 students)

Teaching assistants reviewed AI suggestions.
Students revised essays more successfully
than with human-only feedback.

No significant benefit on the knowledge test.
Revision quality rated by an AI-based evaluator.

[Lu et al. \(2026\), CHI](#)

AI system, AI agent, learning agent

AI systems

AI-based applications

AI agents

Interaction and decisions
within a defined framework

AI learning agents

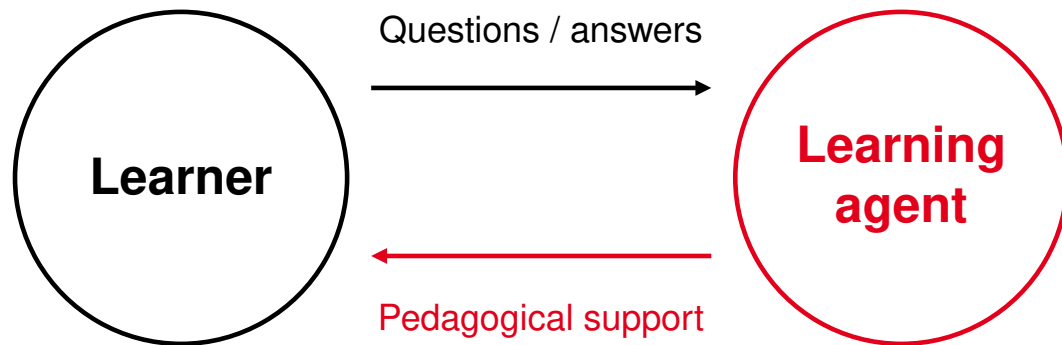
Pedagogically embedded support

AI learning agents

Definition and pedagogical functions

An AI learning agent is a software agent designed to support learning by interpreting learner input and selecting pedagogical actions in relation to learning goals and the learner's current needs.

Adaptive interaction



The next action depends on the learner's response.

Typical functions

Explain and scaffold

Examples, hints and guiding questions.

Provide practice

Tasks, simulations and role-play.

Assess and give feedback

Evaluate responses and suggest next steps.

Support self-regulation

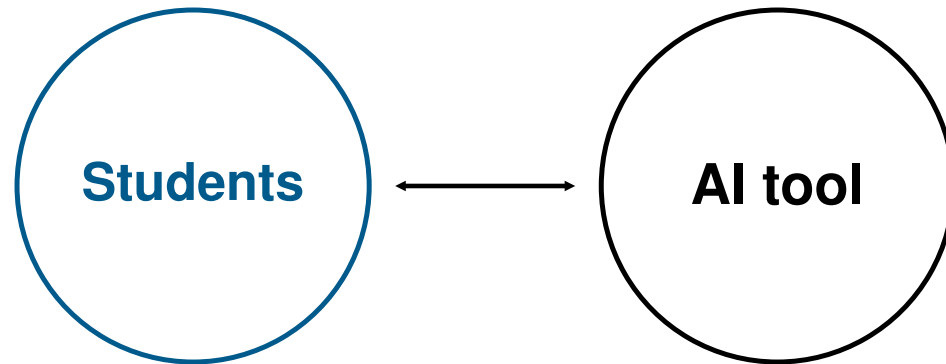
Help with planning, reflection and motivation.

Functions and degree of autonomy depend on the system and its configuration.

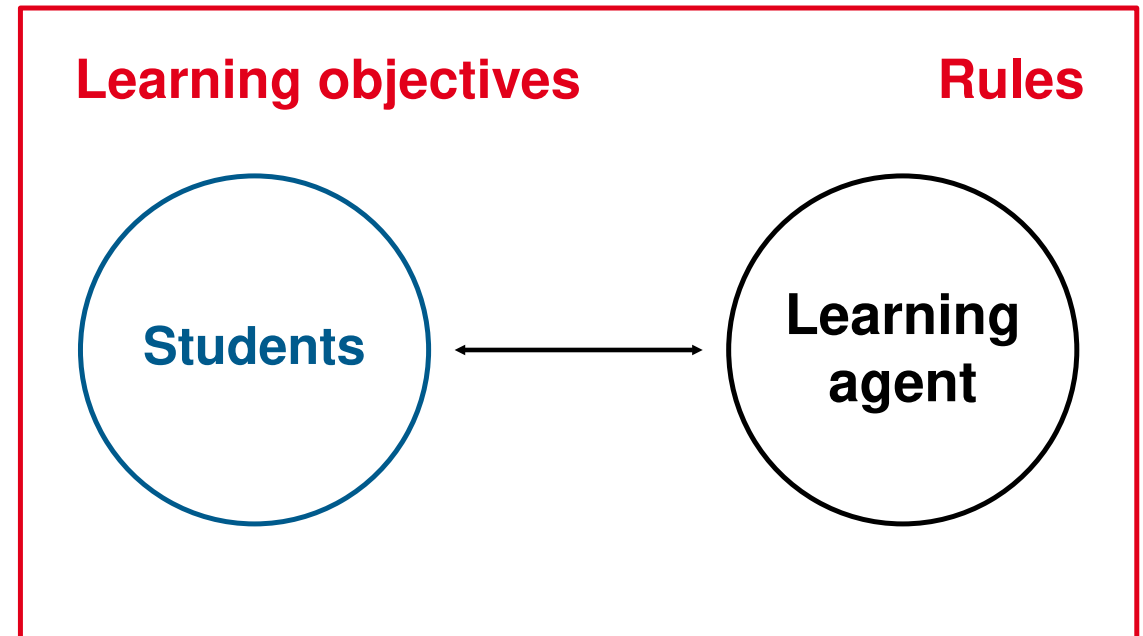
Definition synthesised from [Wooldridge & Jennings \(1995\)](#), [Johnson & Lester \(2018\)](#), and [Yusuf et al. \(2025\)](#).

Pedagogical framing changes how AI is used

Independent tool use



Configured learning space



Tasks and assessment

AI learning agents in Europe



Germany

Course assistance
LMS integration



Germany

Learning paths
Exam practice



Germany

Moodle tutor
Practice feedback



Netherlands

Course tutor
Feedback



LAMB

Spain, open source

Assistant builder
LMS integration



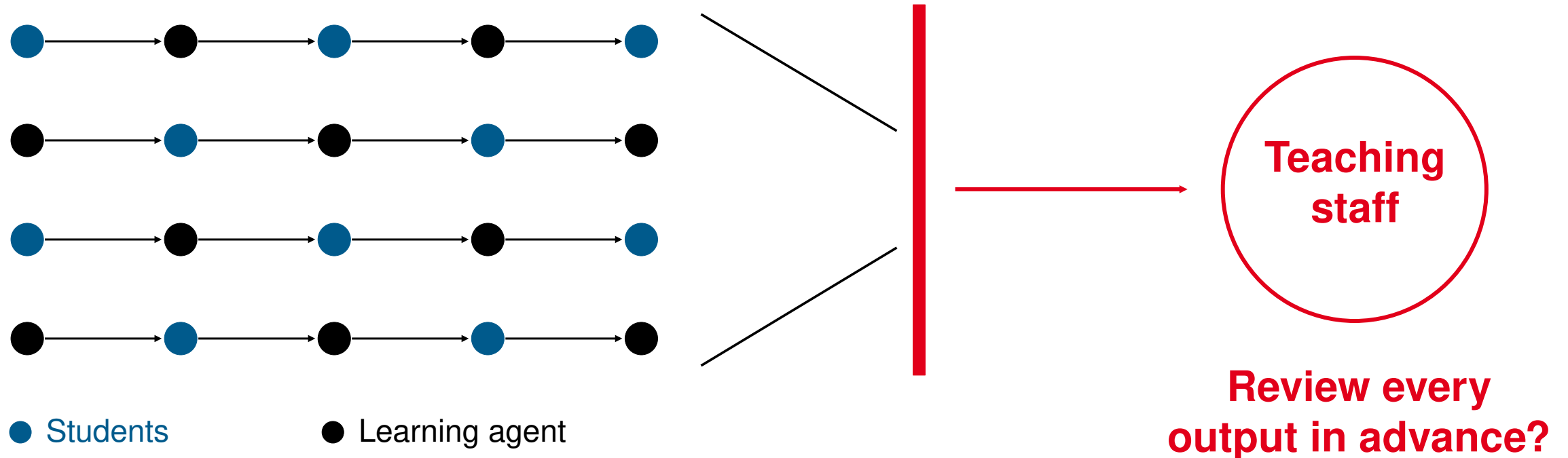
Bochum University, pilot project

Learning space design
Pedagogical configuration

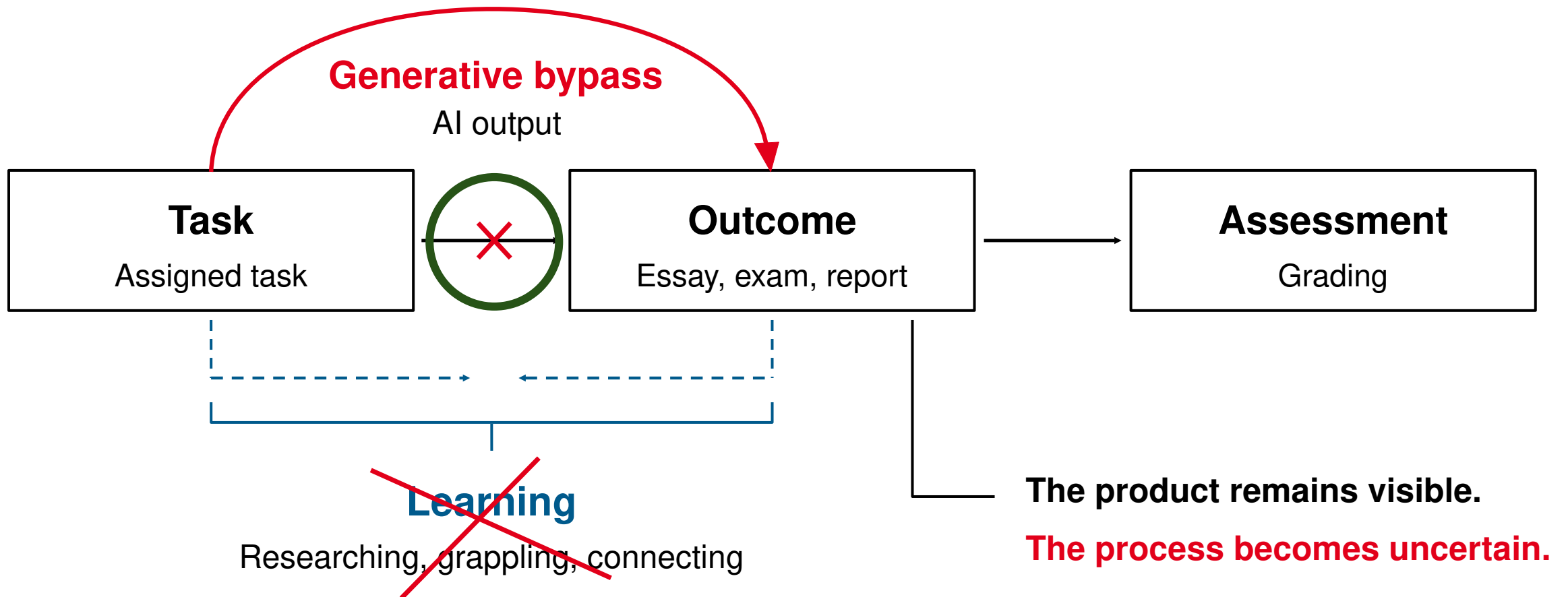
As of October 2026

Dialogic learning agents challenge the model of reviewing every output

Individual learning paths

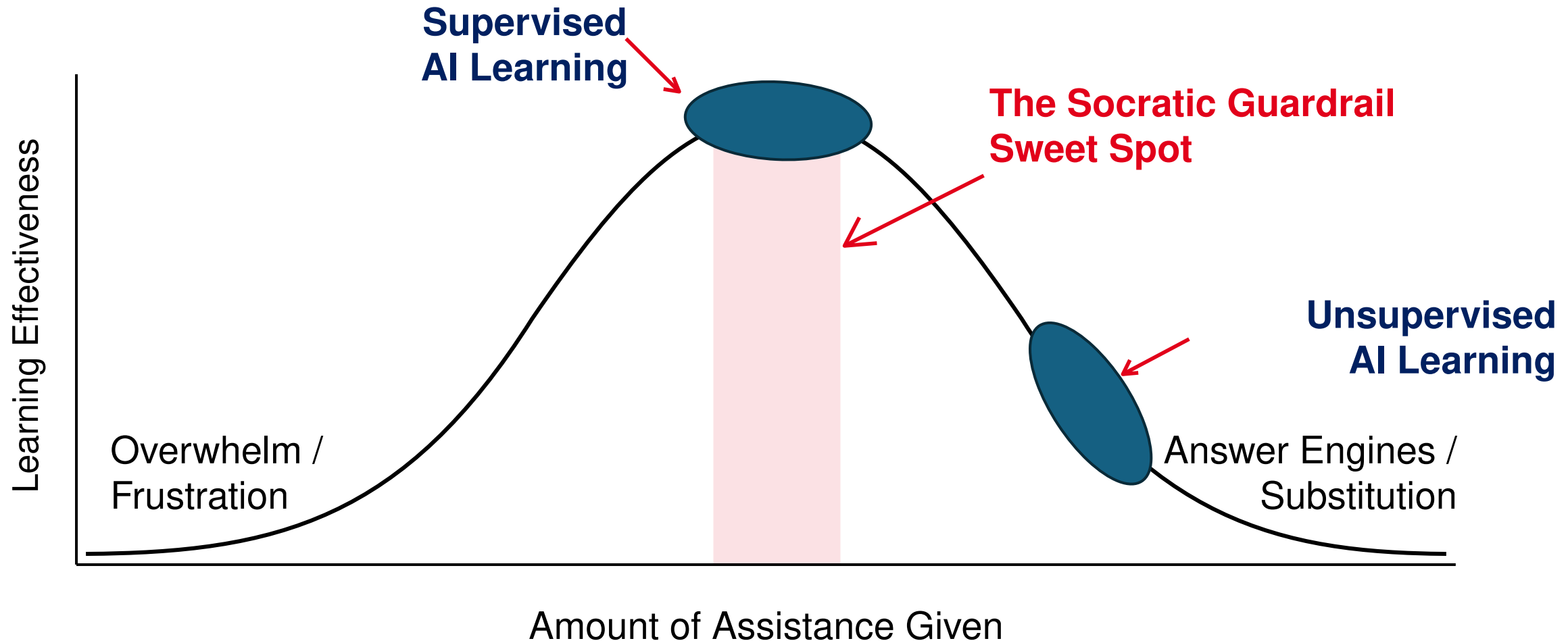


AI can bypass the learning process



Backup

The Assistance Dilemma Curve



Koedinger & Aleven (2007); Wood, Bruner, & Ross (1976)

WOTUM: Project and current status

Write Once – Transfer – Use Multiple



Funded by

**Stiftung Innovation
in der Hochschullehre**

April 2025–March 2027

DigiTeach-Institut, Hochschule Bochum

Project lead: Prof. Dr. Thomas Eder

Project objective

Develop an AI-based learning environment with a didactically curated, course-specific learning agent.

Lecturers define content, learning objectives and support. The agent helps students understand, practise and reflect.

Current status

Working prototype: course configuration + AI learning agent

In teaching trials

Bochum University
Hochschule Bielefeld
Technical University Cologne

150+ students

Planned

LMU Munich
DHBW Karlsruhe
HAW Hamburg
TH Mittelhessen

WOTUM: Setting up courses

Instructor view

Objectives and topics

Veranstaltungs-Lernziele

Erstellen Sie ein Groblernziel für Ihre Veranstaltung. Lernziele beschreiben, die Ihre Studierenden erreichen sollen. Ordnen Sie jedem Lernziel eine Bloom-Stufe zu, um die kognitive Anforderung zu kennzeichnen.

✓ Lernziel hinzugefügt

Fügen Sie hier ein Groblernziel hinzu, es wird Ihrer Veranstaltung zugeordnet. Die Hilfe kann Ihnen einen Vorschlag machen.

Bloom-Stufe
Bloom Level auswählen

Hilfe ↗ Lernziel hinzufügen +

Bestehende Lernziele in der Veranstaltung und in Themengebieten

Verstehen

Die Studierenden verstehen Investitionsrechnung.
Groblernziel direkt zur Veranstaltung zugeordnet

Create courses and topic areas
Define objectives using Bloom's taxonomy
Review and adopt AI suggestions
Define topic prerequisites

Upload materials

Grundlagen der Betriebswirtschaftslehre und Investitionsrechnung

Einordnung betriebswirtschaftlicher Fragestellungen mit Schwerpunkt auf Investitionsentscheidungen und den Grundlagen ihrer rechnerischen Beurteilung.

Vorausgesetztes Themengebiet
Keines

Kontext-Dateien (.md/.pdf)

Markdown- oder PDF-Datei hier hineinziehen
oder
Datei auswählen

V-3, Personal, Auswahl und Einsatz 0.1.pdf
3.5 MB · 07.10.2026, 14:38
Wird verarbeitet

Öffnen

Documents for the whole course
Context files for each topic area
Share materials with students

Create a weekly learning plan

KW	Datum	VE	Themengebiet	Einheit / Sitzung	Zugeordnete Lernziele
KW 1	07.10.2026	VE01	Grundlagen der Betriebswirtschaftslehre und Investitionsrechnung	Einstieg und Einordnung betriebswirtschaftlicher Fragestellungen	Verständnis der Investitionsrechnung vorbereiten (Vorschlag)
KW 2	14.10.2026	VE01	Grundlagen der Betriebswirtschaftslehre und Investitionsrechnung	Betriebliche Entscheidungen und Rolle von Investitionen	Verständnis der Investitionsrechnung vorbereiten (Vorschlag)
KW 3	21.10.2026	VE01	Grundlagen der Betriebswirtschaftslehre und Investitionsrechnung	Investitionsentscheidungen: Grundlagen und Begriffe	Die Studierenden verstehen Investitionsrechnung
KW 4	28.10.2026	VE01	Grundlagen der Betriebswirtschaftslehre und Investitionsrechnung	Überblick über Verfahren der Investitionsrechnung	Die Studierenden verstehen Investitionsrechnung
KW 5	04.11.2026	VE01	Grundlagen der Betriebswirtschaftslehre und Investitionsrechnung	Statische Verfahren: Kostenvergleich	Die Studierenden verstehen Investitionsrechnung

Combine topics, objectives and dates
Use AI to draft a plan
Edit and save the draft

Original screenshots from the WOTUM prototype, October 2026

WOTUM: Configuring and using the learning agent

Instructor and student views

Set the learning mode

Six preconfigured learning modes
e.g. explanation, reflection,
semester support and exam preparation
Configure support and dialogue
behaviour

Use prompt suggestions

My learning path
Explore content
Apply knowledge
Suggestions with background prompts

Learn through chat

Select a topic and learning objective
Ask questions, get explanations, practise
Open and download materials
Plan your learning path and next steps

Agent context: course information, chat history, topic checks and weekly plan

Original screenshots from the WOTUM prototype, October 2026

WOTUM: Topic checks and analytics

Instructor and student views

Create a topic check

Angaben für einen abschließenden Check Check bearbeiten

Check erfasst

Aufgabe
a) Die Werbung folgt dem Maximalprinzip. Die 600 Euro sind vorgegeben; mit diesem Betrag sollen möglichst viele Menschen erreicht werden. Der Auftrag über 50 Laptops folgt dem Minimalprinzip. Die Menge von 50 Laptops und die Qualität sind vorgegeben; der Einsatz von Material und Energie soll möglichst gering sein. b) Nein. Von den erforderliche...

Musterlösung
a) Die Werbung folgt dem Maximalprinzip. Die 600 Euro sind vorgegeben; mit diesem Betrag sollen möglichst viele Menschen erreicht werden. Der Auftrag über 50 Laptops folgt dem Minimalprinzip. Die Menge von 50 Laptops und die Qualität sind vorgegeben; der Einsatz von Material und Energie soll möglichst gering sein. b) Nein. Von den erforderliche...

Bewertungskriterien
Bewertungskriterien intern stehen 12 Feedbackpunkte zur Verfügung, jeweils maximal 4 Punkte für die Teilaufgaben a), b) und c). Der Check ist genau dann „Bestanden“, wenn in JEDER Teilaufgabe mindestens 1 interner Punkt erreicht wird.
Summe A1-A4 ≥ 1 UND Summe B1-B4 ≥ 1 UND Summe C1-C4 ≥ 1 . Zwei teilweise richtige Kriterien mit je 0,5 Punkten...

Provide a task and model answer
Define assessment criteria
Define subtasks and pass conditions

Have answers assessed

Du
Technisches Risiko gibt es nicht. Samir hat keine Strategie und der Vorschlag ist der beste!

Lern-Agent
Das hat leider zum Bestehen noch nicht ausgereicht.

Gib mir eine kleine Hilfestellung

Erkläre mir ausführlich warum

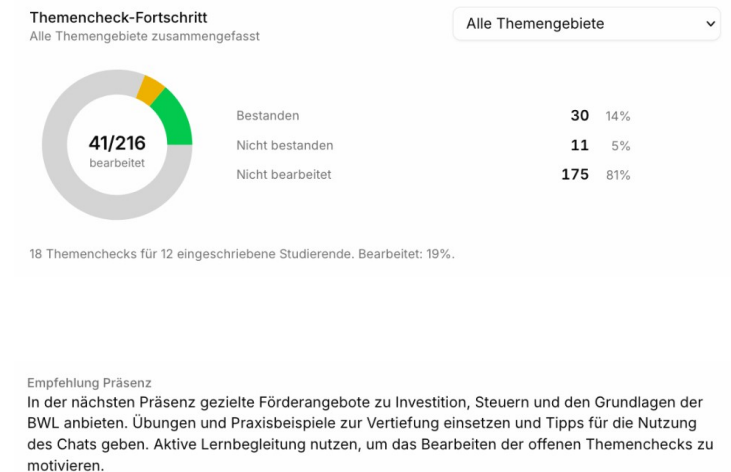
➔ Nochmal!

Check: 01 Grundlagen der Betriebswirtschaftslehre
Noch nicht bestanden

Check: 05 Personalmanagement
Bestanden

Submit your own answer
AI assessment and pass status
Request a hint or explanation
Revise and resubmit the answer

Analyse usage

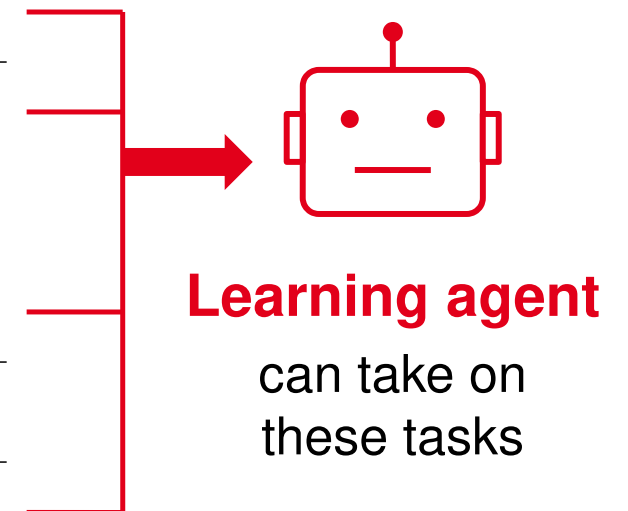


View check progress and usage
Review and export learning activities
Get insights for face-to-face teaching
Adjust materials and configuration

Original screenshots from the WOTUM prototype, October 2026

The tasks of teaching staff

Area	Task
Planning	Define learning objectives
	Plan courses
	Create teaching materials and tasks
Teaching	Explain content and guide practice
	Advise and mentor students
	Review practice answers and give feedback
Assessment	Design exams and grade performance
Organisation	Coordinate and organise teaching
	Evaluate courses



Tasks adapted from van Dijk et al. (2020), Table 3, pp. 8–10. Allocation: author's interpretation.

Loss of epistemic control

Knowledge production

Who produced what?

“Just because students give a presentation does not mean the ideas and wording are their own. They may also come from AI.”

Interview 7

Verifiability

What is academically sound?

“Even when I specify the constraints for the AI, it does not fully take them into account, so the result is wrong.”

Interview 1

What can
teaching staff
keep track of?

Independent work

What is students' own work?

“A student had AI summarise the main points of an academic text, and I think he never read the text himself.”

Interview 12

Teaching role

What is our contribution?

“I would find it problematic if my role as a lecturer were reduced to checking the AI's outputs.”

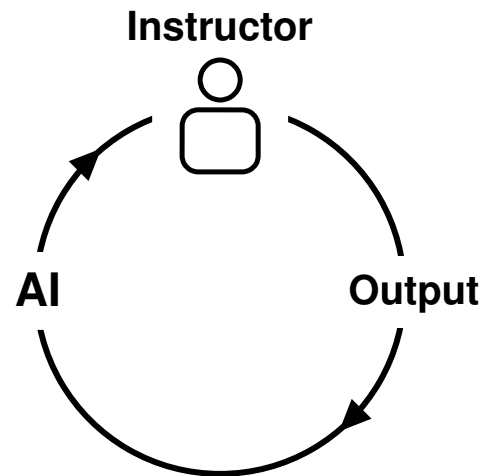
Interview 3

Based on our interview study
Eder, Daniel & Schug (2026)
Who controls whom? · AIAgents4Qual 2026
Interview statements translated and edited.

Human on the Loop: Overseeing the learning space

Human in the Loop

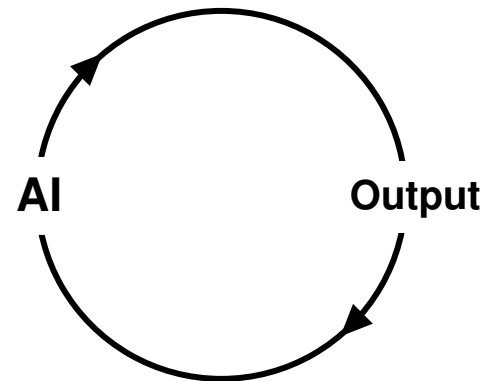
Approval of each output



The instructor reviews and approves each output.

Human out of the Loop

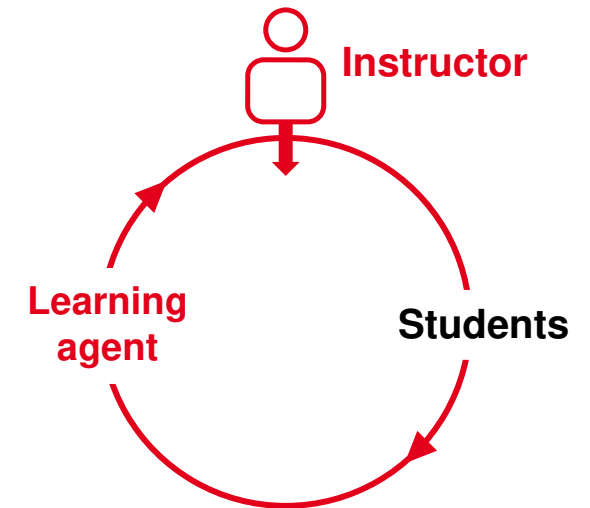
Automated operation



No ongoing human review or intervention within the process shown.

Human on the Loop

Design and oversight



Design the learning space, monitor learning paths, intervene when needed.

AI HLEG (2019), p. 16; Agbeja (2025)

The paper behind this talk

This talk builds on our article in Forum Wissenschaft.

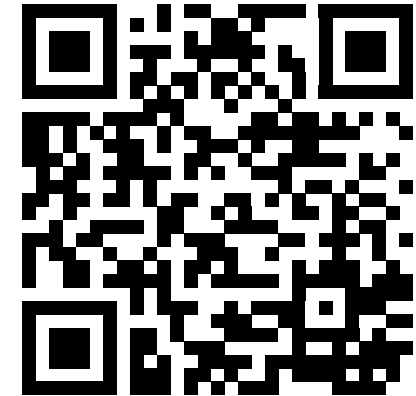
Human-in-the-Loop in der Hochschullehre

Zwischen technischer Outputkontrolle
und konzeptioneller Lernraumgestaltung

Thomas Eder, Jonas Schug & Carolin Daniel

Forum Wissenschaft, 43(2), 9–12 · June 2026

www.bdwi.de/show/11309407.html



Article access

Publisher's issue page

Questions?

Many questions remain open

- 01 How can **teaching roles** change when path dependencies reinforce the familiar model: “I teach by explaining”?
- 02 Will AI learning environments **deliver on their promise, gain students’ acceptance** and become part of everyday teaching?
- 03 How **digitally sovereign** are universities if major US providers restrict access to their models or switch them off?
- 04 How **costly** will large-scale use be, who will pay for it, and could unequal access create an AI divide?
- 05 How can learning agents become context-sensitive without reproducing **disciplinary, cultural or social biases**?
- 06 How do we embed these environments in **curricula**, and rethink **grading** and “natural assessment”?

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