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Systems Architecture on Day One

Two semesters of compulsory AI in graduate courses at the Technical University of Munich

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Systems Workforce Summit II, Academia and Education theme
Delft, 27-28 October 2026

Prepared with AI (Claude, Anthropic) from my lectures, lecture notes and field notes. The judgement and the accountability are mine. Declared and logged, as I ask of my students.

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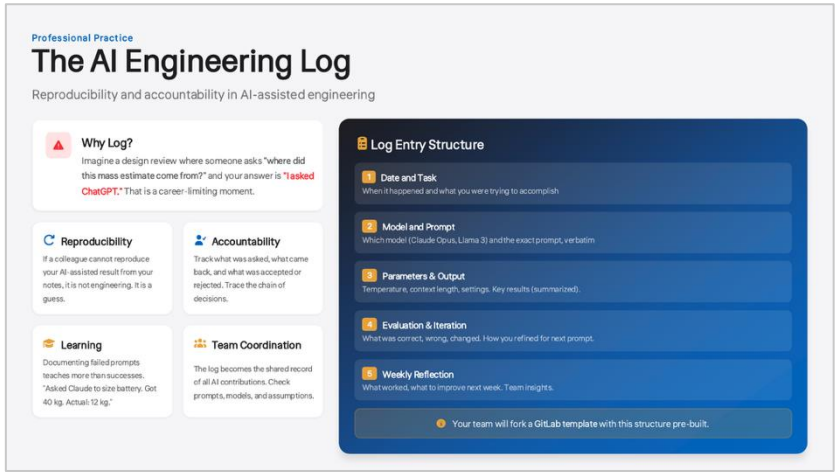
AI use is compulsory in my courses, under two simple rules

1 **Students must use AI.**

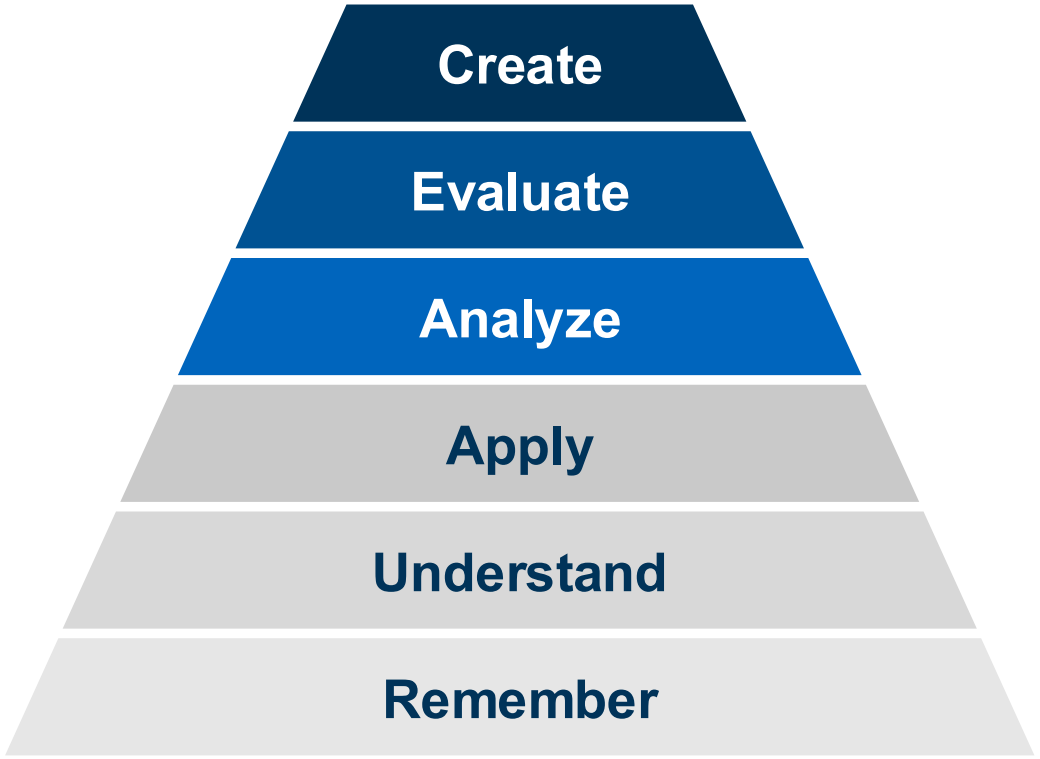
2 **AI counts as a member of the team.**
The assessment covers how they integrated it as well as what they delivered.

- Students remain responsible and accountable for the outcome.
- The ambition of the assignments rises to match the capability.
- Students declare and log their use. The log is graded.
- The same transparency holds for the work faculty sign.





The student's job has moved to the top of Bloom's pyramid



What to keep
New data, new ideas, the architecture

How to evaluate
Verify, validate, accept or reject

What to delegate
Frame and decompose the problem

20%
Student-driven

First-order sizing
Procedures, calculations, code

Explanation
Tutoring and the static lecture

Retrieval
Facts, data and references

80%
AI-driven Student validates

AI takes a student 80% of the way in no time. The last 20% is the engineering job. AI substitutes at the base of the pyramid and complements at the top.

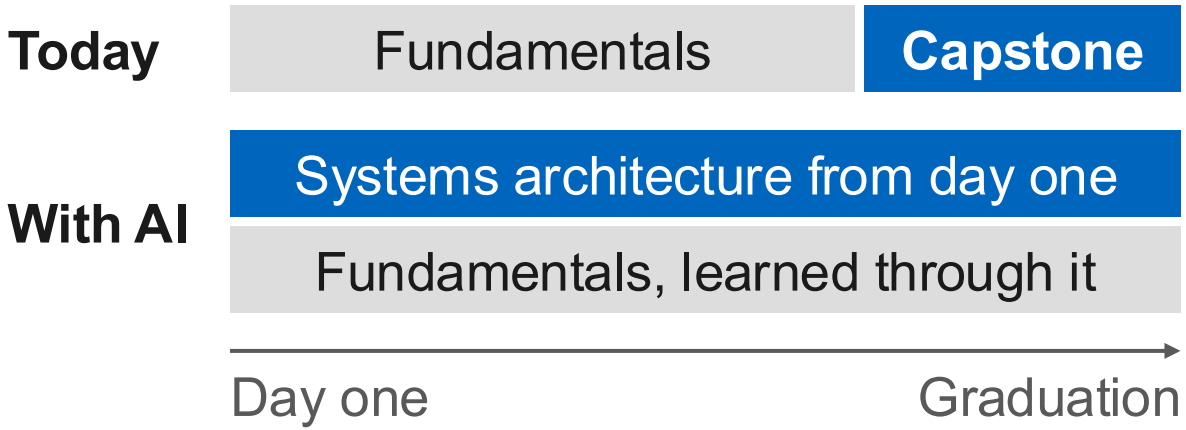
Levels: revised Bloom's taxonomy (Anderson and Krathwohl, 2001). Allocation: my reading after two semesters of compulsory AI at TUM.

That 20% is systems architecture, so it belongs on day one

AI is the epitome of complexity.

Systems thinking structures the question, provides the process and brings proven methods to build complex systems.

Orchestrating AI is a new-not-so-new skill, and systems architecture is its cornerstone.



AI is rediscovering systems engineering

Heard at World Summit AI 2026, Amsterdam	Systems engineering
Evals: what good looks like	Requirements and acceptance criteria
Harness: loop, tools, interfaces	Architecture and interface control
Traces of each agent step	Telemetry and test records
Autonomy per decision class	Function allocation, autonomy levels
Sign-off before production	Qualification and acceptance reviews

Source: my World Summit AI 2026 field report (Amsterdam, 7-8 October).

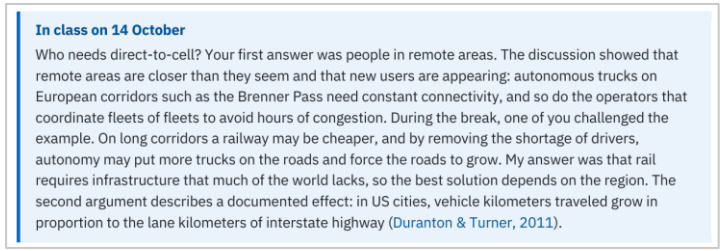
Class time must build the judgement novices lack

AI is powerful in the hands of seniors, who built critical thinking and domain knowledge before AI.

Novices have to build that judgement while using AI.

> *"If we continue to offload more work to AI, the craft dissipates."*
>
> Yuval Dvir, World Summit AI, 8 October 2026

The lecture goes to AI



In class on 14 October

Who needs direct-to-cell? Your first answer was people in remote areas. The discussion showed that remote areas are closer than they seem and that new users are appearing: autonomous trucks on European corridors such as the Brenner Pass need constant connectivity, and so do the operators that coordinate fleets of fleets to avoid hours of congestion. During the break, one of you challenged the example. On long corridors a railway may be cheaper, and by removing the shortage of drivers, autonomy may put more trucks on the roads and force the roads to grow. My answer was that rail requires infrastructure that much of the world lacks, so the best solution depends on the region. The second argument describes a documented effect: in US cities, vehicle kilometers traveled grow in proportion to the lane kilometers of interstate highway (Duranton & Turner, 2011).

2-hour recording, 24-page chapter, edited by me. Next: a course chatbot.

Class time for experience

> *"…my experience that you will not find in textbooks and you will not find on Claude."*
>
> To my students, 14 October 2026

My experience and approaches, and a running case renewed each semester.

Validation is practised

Spot the failure

$\sigma = 5.67 \times 10^{-9}\ \mathrm{W\ m^{-2}\ K^{-4}}$

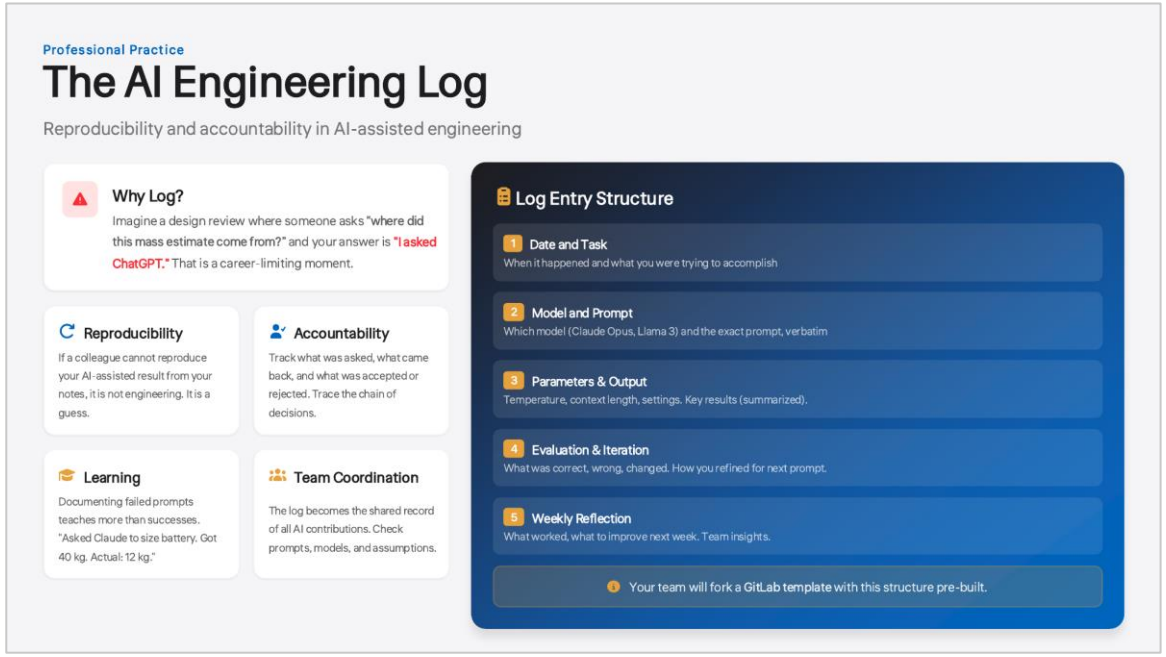
One of three seeded errors

Seeded errors, the evaluation column of the log, oral defence.

Five recommendations for the Delft Systems Declaration

1. **Make AI use compulsory, declared and logged,** for students and for the work faculty sign. Assess the integration as well as the deliverable, and raise the ambition.
2. **Teach systems architecture and systems thinking from day one,** and reverse the capstone sequence.
3. **Train and grade judgement on purpose** from the first semester: seeded-error exercises, the AI log, oral defence of AI-assisted work.
4. **Give class time to the top of Bloom's taxonomy:** experience, approaches, case studies renewed each semester. Hand the static lecture to AI notes and chatbots.
5. **Measure how novices build judgement with AI,** through longitudinal studies shared across our universities.

Backup: every AI-assisted result traces to a log entry



“In a design review, ‘I asked ChatGPT’ is not an acceptable answer.”

Rule of the AI Engineering Log, the spreadsheet every team keeps in its repository

Example entry from the log template

Task	Size the solar array of a small satellite in a 600 km Sun-synchronous orbit
Output	About 0.62 m² of array at end of life, with 15% margin
Check	Second model and back-of-the-envelope: passed, 0.58 m², within 7%
Decision	Used as a starting point
Lesson	The model assumed an eclipse fraction of 0.36; the actual is 0.39

Backup: the Editor Test sets what students may delegate

Would you ask a human colleague to do this task, and would everyone think that is acceptable?

OK

Research

A colleague researches; you read the findings and draw your own conclusions.

OK

Discussion

You talk through your ideas and hear another view.

OK

Editing

You get suggestions on your draft and accept or reject them.

No

Writing for you

Nobody asks an editor to write a chapter and pastes it into a thesis.

If you cannot explain and defend every sentence, it is not yours.

Kept out of cloud AI: personal data, proprietary data, client-confidential information and export-controlled technical data. When in doubt, a local model.

Backup: World Summit AI 2026 gave learning 1 session of 136

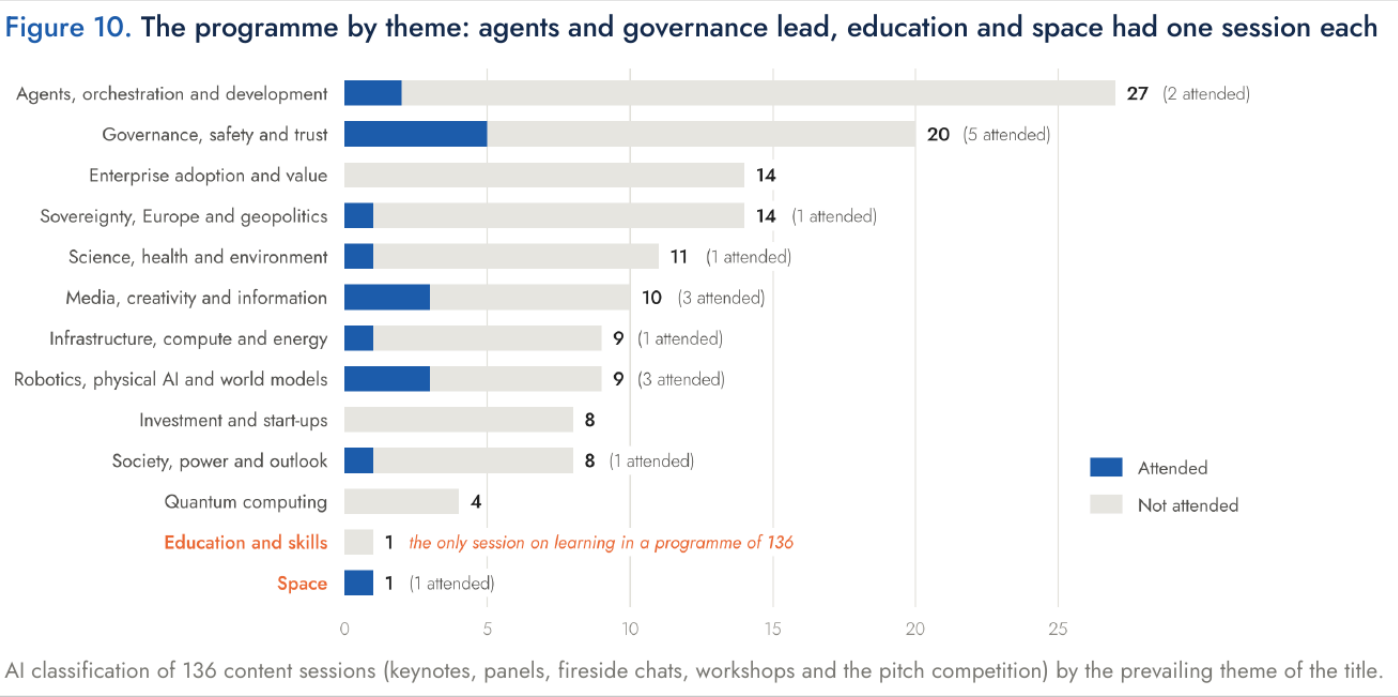
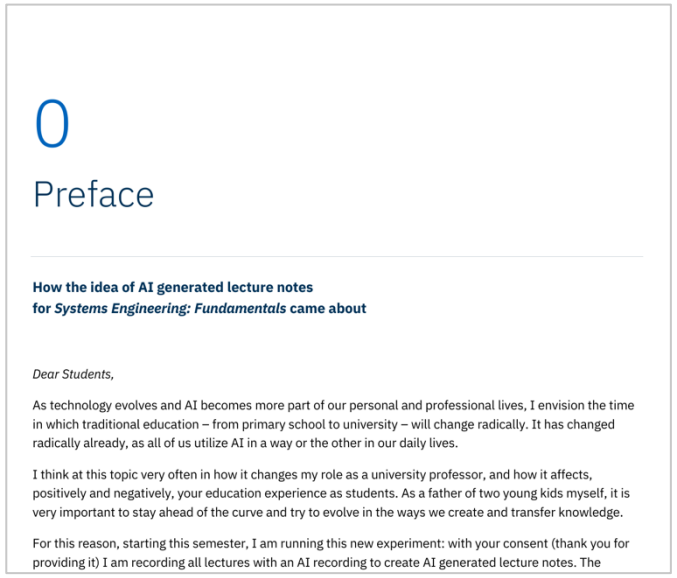


Figure 10 of my field report, generated with AI from my recordings and notes; sessions classified by AI.

- Education for AI and AI for education was the most visible gap: raised often on stage, with no education exhibitor among the stands I visited.
- The concerns heard most were cognitive offloading, attention, loss of craft and the ability to direct agents.
- No session I attended presented evidence on which uses of AI build skill and which erode it.

Backup: how the lecture notes are produced

1. Record the lecture, with consent
2. Transcribe: 20,765 words for lecture 1
3. AI draft from transcript and slides
4. Check sources; add the class discussion
5. Edit, distribute, invite corrections



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Preface

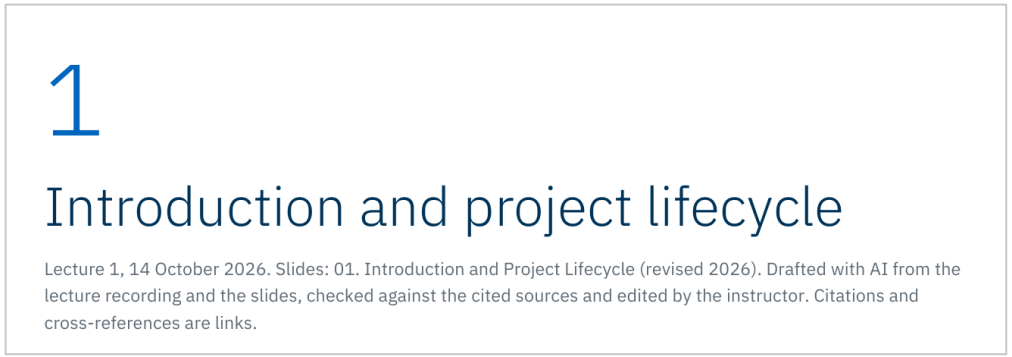
How the idea of AI generated lecture notes for *Systems Engineering: Fundamentals* came about

Dear Students,

As technology evolves and AI becomes more part of our personal and professional lives, I envision the time in which traditional education – from primary school to university – will change radically. It has changed radically already, as all of us utilize AI in a way or the other in our daily lives.

I think at this topic very often in how it changes my role as a university professor, and how it affects, positively and negatively, your education experience as students. As a father of two young kids myself, it is very important to stay ahead of the curve and try to evolve in the ways we create and transfer knowledge.

For this reason, starting this semester, I am running this new experiment: with your consent (thank you for providing it) I am recording all lectures with an AI recording to create AI generated lecture notes. The



1

Introduction and project lifecycle

Lecture 1, 14 October 2026. Slides: 01. Introduction and Project Lifecycle (revised 2026). Drafted with AI from the lecture recording and the slides, checked against the cited sources and edited by the instructor. Citations and cross-references are links.

Preface to the students and the first page of chapter 1, Systems Engineering Fundamentals, Winter 2026

- Students consented to the recording.
- I review and edit every chapter before it goes out.
- The notes change every time I teach the class.

Backup: exercises that train validation

Fix This Prompt

“Design me a satellite power subsystem.”

In pairs, students add orbit, eclipse, payload power, constraints, design life and an iteration strategy, then pitch.

Red Flag, Green Flag

Green: AI drafts a traceability matrix and a human verifies every link.

Red: AI writes verification procedures for safety-critical requirements, submitted directly.

Amber: cloud AI on live mission telemetry.

Spot the Failure

A radiator sized with $\sigma = 5.67 \times 10^{-9}$ W m^{-2} K^{-4}, an area that fails a back-calculation and a reference that does not exist.

First team to find all three wins.

Adapted per course: spacecraft design, systems engineering and New Space Economy.