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New Perspectives in Science Education

International Conference
NEW PERSPECTIVES in SCIENCE EDUCATION

In the Era of AI: Small-Scale Strategies to Enrich Computer Science Education through an Integrated AI Track, a Case of AI as a Companion in Academic Writing in the First-Year Computer Science Course

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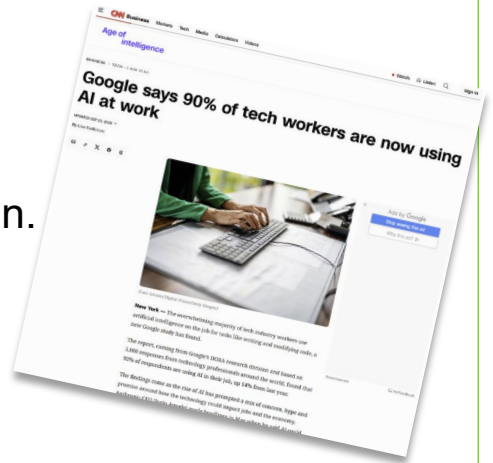
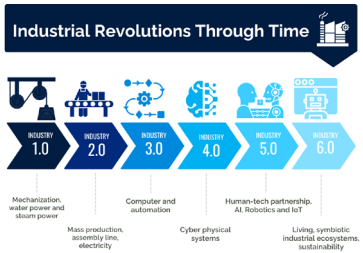
Why This Study?

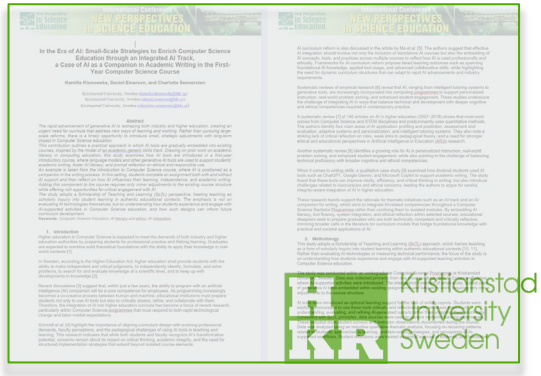
- Generative AI is rapidly transforming industry and higher education.
- Universities must respond — but how?
- Programming with AI companions is becoming core competence.





[What is Industry 6.0? What Does the Next Industrial Leap Look Like? - HGS]

[What's Next: Top Five Trends in Education for 2025]



Why This Study?

- How can we integrate AI into CS education **without large curriculum reform**?

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The Problem

- Literature shows:
  - AI is widely used in higher education.
  - Limited critical reflection on risks.
  - Weak pedagogical grounding.
  - Ethical concerns (fabricated references, integrity).
  - And more…

[4] Schmidt, D. A., Alboloushi, B., Thomas, A., and Magalhaes, R., “Integrating artificial intelligence in higher education: perceptions, challenges, and strategies for academic innovation”, Computers and Education Open, vol. 9, p. 100274, Dec. 2025, doi: 10.1016/j.caeo.2025.100274.
[5] Ma, Y. et al., “Preparing Students for an AI-Driven World: Generative AI and Curriculum Reform in Higher Education”, Front. Digit. Educ., vol. 2, no. 4, p. 30, Dec. 2025, doi: 10.1007/s44366-025-0067-6.
[6] Zhu, M. and Zhang, K., “Artificial Intelligence for Computer Science Education in Higher Education: A Systematic Review of Empirical Research Published in 2003–2023”, Tech Know Learn, vol. 30, no. 4, pp. 2417–2441, Dec. 2025, doi: 10.1007/s10758-025-09859-1.
[7] Zawacki-Richter, O., Marín, V. I., Bond, M. and Gouverneur, F., “Systematic review of research on artificial intelligence applications in higher education – where are the educators?”, Int J Educ Technol High Educ, vol. 16, no. 1, p. 39, Dec. 2019, doi: 10.1186/s41239-019-0171-0.
[8] Gaitantzi, A. and Kazanidis, I., “The Role of Artificial Intelligence in Computer Science Education: A Systematic Review with a Focus on Database Instruction”, Applied Sciences, vol. 15, no. 7, p. 3960, Apr. 2025, doi: 10.3390/app15073960.
[9] Bista, K. and Bista, R., “Leveraging AI tools in academic writing: Insights from doctoral students on benefits and challenges”, STEM, vol. 6, pp. 32–47, Feb. 2025, doi: 10.32674/9m8dq081.

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Our Approach

- Instead of:
  - Creating new AI (competencies) courses
  - Large-scale curriculum reform

- We propose:
  - Small, strategic adjustments
  - Embedding AI competencies into selected courses
  - Using existing ***thematic track model***

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Model → Thematic Tracks at CS@HKR

- Over 10 years of experience with:
  - Academic Generic Skills Track
  - Innovation Track
  - Sustainable Development Track

- Core principle:
  - Embed competencies into existing courses → do not isolate them

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From Academic Skills Track to AI Track

Table 1: Academic and communicative learning objectives in the academic generic skills track [12]

Year 1 • express themselves in correct written language, use basic concepts within the subject of computer science, and follow established requirements for format, structure, and referencing; • clearly and structurally present their own work, for example, project work; • apply a source-critical approach in connection with basic information searches; • constructively discuss their own and other students' work; • understand the meaning of a scientific approach and apply it to simpler problem settings; • make basic judgements with regard to relevant scientific, societal, and ethical aspects.
Year 2 • use effective discipline-specific language and be able to write documents such as shorter project reports and laboratory reports, in accordance with academic requirements for language and format; • apply a source-critical approach to given problem settings; • carry out a presentation in line with academic requirements for language and format and, in that context, be able to argue using theoretical concepts from computer science; • analyse and give constructive feedback on their own and others' work; • make judgements with regard to relevant scientific, societal, and ethical aspects.
Year 3 • produce documents, such as larger project reports, in accordance with established academic requirements for language and format, and clearly argue using theoretical concepts from computer science; • apply a source-critical approach in connection with information searches; • relate documented research results to their own and other students' problem settings; • make more in-depth judgements with regard to scientific, societal, and ethical aspects relevant to the field of computer science; • use a critical approach and scientific methods to carry out an academic piece of work; • deliver an academic presentation and clearly argue using theoretical concepts from computer science; • carry out a formal opposition (critical review) of another student's work.

Progression:

Year 1: Awareness

Year 2: Application

Year 3: Strategic integration

Inspired by Ma et al. (2025), we define AI Track goals:

- AI literacy
- Critical evaluation of AI output
- Tool fluency
- System integration
- Ethical reflection

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Case Study: Introduction to Computer Science (Year 1)

- Course: DA100D (7.5 credits)
- One lecture on AI, one lecture on SDG, one lecture on Ethics (= 6h)
- New component introduced: “AI as companion in academic writing”.
- Assignment structure:
  - Part 1 (WITHOUT): you will do the work by yourself (see description below).
  - Part 2 (WITH): you will write a prompt so the AI-tool will generate a report with the same conditions and same subject. Remember to ask for scientific references!
  - Part 3 (COMPARE): you will ask AI-tool to correct the grammar and language of the report from part 1. Note! It is important that you do not show your report to AI-tool before you prompt it.
  - Part 4 (ETHICS): you will write a reflection on the experiment

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Research Design

- Methodology:
  - Scholarship of Teaching and Learning (SoTL)
  - Analysis of around 300 student reports
  - Voluntary participation
  - Anonymized reflections

- Focus:
  - Evaluating student learning experience.

Results: Writing **Without** AI

- Students reported:

Deeper understanding
Better source engagement
Stronger ownership of text
Increased critical thinking

More time-consuming
Frustration at start

"I am a fan of using AI as help in my work, and not being able to use it in the first part of this assignment made it very frustrating and I felt like I had a hard time getting started. When I eventually figured out what to write about and got to work, I liked the way I was able to find my sources of information, and I felt like I got to learn and have a better understanding of what I was writing about. I've never been a big writer, and it is challenging in this era where AI has such a big influence and takes up a big part of most people's lives. For example, I find myself using the same words and phrases repeatedly and when I reread what I wrote I must go back and change my text, so it doesn't become repetitive."

"Working on part 1 of the experiment was time consuming, but it was an important step for deep learning and critical thinking. The search for truly relevant information and mastering skills like referencing are crucial steps for learning and writing at a high level. In comparison to the part 2 text written by AI, which provided an instant result. However, the AI generated content contained hallucinated or incorrect references. Most of the references Poe AI gave had URLs that led to a "page not found" or "error 404". This experiment shows clear evidence that AI was a perfect tool for grammatical errors (part 3), but it can not replace the necessity of human intellectual effort for critical thinking."

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Results: Writing **With** AI

- Students reported:

Improved efficiency
Better grammar and structure

Fabricated references
Hallucinated sources
Vague formulations
Need for careful oversight

"Working on part 1 of the experiment was time consuming, but it was an important step for deep learning and critical thinking. The search for truly relevant information and mastering skills like referencing are crucial steps for learning and writing at a high level. In comparison to the part 2 text written by AI, which provided an instant result. However, the AI generated content contained hallucinated or incorrect references. Most of the references Poe AI gave had URLs that led to a "page not found" or "error 404". This experiment shows clear evidence that AI was a perfect tool for grammatical errors (part 3), but it can not replace the necessity of human intellectual effort for critical thinking."

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Comparison (with vs without AI)

- Students perceived:

Independent writing → deeper learning
AI-supported writing → efficient but cognitively lighter

- Key insight: AI changes workflow from production to evaluation.
- Critical oversight becomes central.

"Comparing the two approaches, I noticed that working independently required more creativity and critical thinking, while using AI was more efficient but needed careful oversight. AI felt like a helpful assistant, but the responsibility for accuracy and ethical writing remained with me.
The experiment also made me think about ethical considerations. I realized that relying too heavily on AI could reduce personal effort or introduce mistakes. AI can be a valuable tool for research, but I still had to verify sources, check facts, and make sure the work reflected my understanding and voice.
Overall, this experience has given me insight into how AI can support learning while highlighting the importance of human judgment, ethics, and critical thinking. I believe reflecting on this process can help better understand the role of AI in education, showing both its benefits and limitations."

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Ethical Reflections

- Students identified:
  - Risk of fabricated references
  - Overreliance
  - Academic integrity concerns
  - Privacy issues
  - Responsibility remains human

- Strong alignment with ethical AI integration frameworks.

"Ethical considerations
One ethical issue was that the AI sometimes gave wrong or fake sources. That made me think about honesty in research. If someone uses AI without checking the facts, it can spread false information. Another issue is privacy, because AI tools also collect data from users. Using AI in research means you must be careful with what you share. AI also makes it easier to copy ideas without fully understanding them, which can be unfair or dishonest. (So as mentioned earlier, using AI generally is not a bad idea as long as the user knows when it's needed and implements proper rules.)"

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Reflection & discussion

Several important questions remain:

- Does an AI-based assistant supervisor affect students' self-directed learning?
- Should universities first focus on developing students' self-efficacy and foundational skills without AI support, and only later introduce AI as a complementary learning tool?
- At what point during a three-year bachelor programme should AI be formally integrated as a secondary supervisor or learning companion, rather than being used informally by students without pedagogical guidance?