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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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Abstract

The rapid advancement of generative AI is reshaping both industry and higher education, creating an urgent need for curricula that address new ways of learning and working. Rather than pursuing large-scale reforms, there is a timely opportunity to introduce small, strategic adjustments with long-term impact in Computer Science education.
This contribution outlines a practical approach in which AI tools are gradually embedded into existing courses, inspired by the model of an academic generic skills track. Drawing on prior work on academic literacy in computing education, this study examines how AI tools are introduced in a first-year introductory course, where language models and other generative AI tools are used to support students' academic writing, foster AI literacy, and prompt reflection on ethical and responsible use.
An example is taken from the Introduction to Computer Science course, where AI is positioned as a companion in the writing process. In this setting, students complete an assignment both with and without AI support and then reflect on how AI influences their learning, independence, and academic writing. Adding this component to the course requires only minor adjustments to the existing course structure while offering rich opportunities for critical engagement with AI.
The study adopts a Scholarship of Teaching and Learning (SoTL) perspective, treating teaching as scholarly inquiry into student learning in authentic educational contexts. The emphasis is not on evaluating AI technologies themselves, but on understanding how students experience and engage with AI-supported activities in Computer Science education, and how such designs can inform future curriculum development.

Keywords: *Computer Science Education, AI literacy and ethics, AI integration*

1. Introduction

Higher education in Computer Science is expected to meet the demands of both industry and higher education authorities by preparing students for professional practice and lifelong learning. Graduates are expected to combine solid theoretical foundations with the ability to apply their knowledge in real-world contexts [1].

In Sweden, according to the Higher Education Act, higher education shall provide students with the ability to make independent and critical judgments, to independently identify, formulate, and solve problems, to search for and evaluate knowledge at a scientific level, and to keep up with developments in knowledge [2].

Recent discussions [3] suggest that, within just a few years, the ability to program with an artificial intelligence (AI) companion will be a core competence for employees. As programming increasingly becomes a co-creative process between human and machine, educational institutions must prepare students not only to use AI tools but also to critically assess, refine, and collaborate with them. Therefore, the integration of AI into higher education curricula has become a focus of recent research, particularly within Computer Science programmes that must respond to both rapid technological change and labor market expectations.

Schmidt et al. [4] highlight the importance of aligning curriculum design with evolving professional demands, faculty perceptions, and the pedagogical challenges of using AI tools in teaching and

learning. This research indicates that while both students and faculty recognize AI's transformative potential, concerns remain about its impact on critical thinking, academic integrity, and the need for structured implementation strategies that extend beyond isolated course elements.

AI curriculum reform is also discussed in the article by Ma et al. [5]. The authors suggest that effective AI integration should involve not only the inclusion of standalone AI courses but also the embedding of AI concepts, tools, and practices across multiple courses to reflect how AI is used professionally and ethically. Frameworks for AI curriculum reform propose tiered learning outcomes such as spanning foundational AI knowledge, applied tool usage, and advanced collaborative skills, while highlighting the need for dynamic curriculum structures that can adapt to rapid AI advancements and industry requirements.

Systematic reviews of empirical research [6] reveal that AI, ranging from intelligent tutoring systems to generative tools, are increasingly incorporated into computing programmes to support personalized instruction, real-world problem solving, and enhanced student engagement. These studies underscore the challenge of integrating AI in ways that balance technical skill development with deeper cognitive and ethical competencies required in contemporary practice.

A systematic review [7] of 146 articles on AI in higher education (2007–2018) shows that most work comes from Computer Science and STEM disciplines and predominantly uses quantitative methods. The authors identify four main areas of AI application: profiling and prediction, assessment and evaluation, adaptive systems and personalization, and intelligent tutoring systems. They also note a striking lack of critical reflection on risks, weak links to pedagogical theory, and a need for stronger ethical and educational perspectives in Artificial Intelligence in Education (AIEd) research.

Another systematic review [8] identifies a growing role for AI in personalized instruction, real-world problem solving, and enhanced student engagement, while also pointing to the challenge of balancing technical proficiency with broader cognitive and ethical competencies.

When it comes to writing skills, a qualitative case study [9] examined how doctoral students used AI tools such as ChatGPT, Google Gemini, and Microsoft Copilot to support academic writing. The study found that these tools can improve clarity, efficiency, and critical thinking in writing, but also introduce challenges related to inaccuracies and ethical concerns, leading the authors to argue for careful, integrity-aware integration of AI in higher education.

These research trends support the rationale for thematic initiatives such as an AI track and an AI companion for writing, which aims to integrate AI-related competencies throughout a Computer Science Bachelor Programme rather than confining them to isolated modules. By embedding AI literacy, tool fluency, system integration, and ethical reflection within selected courses, educational designers seek to prepare graduates who are both technically competent and critically reflective, mirroring broader calls in the literature for curriculum models that bridge foundational knowledge with practical and societal applications of AI.

2. Methodology

This study adopts a Scholarship of Teaching and Learning (SoTL) approach, which frames teaching as a form of scholarly inquiry into student learning within authentic educational contexts [10, 11]. Rather than evaluating AI technologies or measuring technical performance, the focus of the study is on understanding how students experience and engage with AI-supported learning activities in Computer Science education.

The study was conducted within an undergraduate Computer Science Programme at Kristianstad University, Sweden. Data was collected primarily from one course, *Introduction to Computer Science*, where AI-supported activities were introduced. The intervention consisted of small-scale, guided uses of generative AI tools embedded within existing assignments and laboratory work, requiring only minor adjustments to the course structure.

AI tools were introduced as optional learning support for the task of writing reports. Students were explicitly encouraged to use these tools critically and reflectively, with emphasis placed on understanding, evaluating, and refining AI-generated outputs rather than accepting them uncritically. Consistent with SoTL principles, data sources were used to capture students' learning experiences. These included short student surveys and instructor observations documented during the course. Data was analyzed using an inductive qualitative thematic analysis, focusing on recurring patterns related to students' approaches to learning, problem-solving strategies, and perceptions of AI-supported workflows. Student reflections were treated as central sources of evidence, and instructors adopted a reflexive stance by examining their pedagogical assumptions and instructional decisions throughout the study.

Participation was voluntary, and all data were anonymized before analysis. The study focused on learning activities already embedded in the course and did not affect student assessment.

3. Thematic Tracks at CS@HKR

The Department of Computer Science at Kristianstad University (CS@HKR), Sweden, has more than ten years of experience in integrating several thematic tracks into its programmes, including an academic generic skills track [12], an innovation track [13], and a sustainable development track [14]. A central objective of integrating these thematic tracks has been to embed the targeted competencies directly into existing curricula rather than introducing separate course components, thereby avoiding explicit additional assessment and grading while still achieving measurable educational outcomes in a cost-efficient and resource-conscious manner.

A key principle underlying the implementation of a thematic track is that it need not be incorporated into all courses within a programme; instead, its effectiveness depends on the careful selection of courses in which the intended learning objectives can be most naturally and meaningfully integrated. The first challenge is therefore to identify courses that allow for a modest pedagogical shift toward the track's goals, enabling individual courses to "swing" slightly in focus where these goals align with existing content and learning outcomes.

For example, the academic generic skills track in a Computer Science Bachelor Programme follows this principle by systematically embedding academic generic skills (see Table 1) across selected courses rather than offering them in a single, standalone module. In this way, students progressively develop the ability to engage with scientific literature, structure academic writing, reference appropriately, and conduct peer review — beginning with fundamental academic generic skills in the first year, advancing to critical analysis and more independent scholarly work in the second years, and culminating in the ability to conduct and communicate research effectively in the final year, particularly through the bachelor's thesis.

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.

The main idea is to embed academic learning objectives within course content and assignments so that students develop their academic competence while engaging with subject-specific content. Such an approach ensures coherence across the programme while preserving the integrity of core disciplinary knowledge. Moreover, concentrating on the thematic track within strategically chosen courses allows for more efficient use of resources and facilitates alignment with existing assessment practices, thereby reinforcing the embedded nature of the track without introducing additional grading or administrative complexity. Building on this model, the innovation track [13] and sustainability track [14] have been implemented to embed targeted competencies without overhauling the entire curriculum.

One example that combines both the academic generic skills track and the sustainability track is to introduce students to academic writing in the *Introduction to Computer Science* course by giving them an assignment on the role of computer science in achieving the Sustainable Development Goals (SDGs). In later courses, students read and reflect on research articles related to specific subjects, with, for example, particular attention to the underlying scientific methods.

Implementation of an AI thematic track introduces a new type of challenge compared to previous tracks. Unlike earlier themes, the AI track must address not only curricular integration but also the rapid technological evolution of AI tools and their widespread use in industry. This requires careful consideration of how AI-supported practices can be embedded into selected courses in a cost-efficient manner, while ensuring high educational impact and preserving essential learning outcomes such as theoretical understanding, critical thinking, and independent problem-solving. At the same time, labor-market demands in artificial intelligence and system development require newly graduated developers to possess a broad set of competencies that extend beyond purely technical skills. These include data literacy, system integration capabilities, effective communication, and an understanding of ethical and legal considerations associated with the development and deployment of AI-based systems.

Following Ma et al. [5], the AI track should consist of:
- understanding AI fundamentals,
- critically evaluating AI-generated content,
- applying AI-powered tools,
- analyzing the broader societal impact of generative AI, and
- cultivating a growth mindset that prepares students to engage with and adapt to emerging AI technologies and their applications.

In the era of AI, we asked ChatGPT to convert the CS@HKR academic generic skills track into a new AI track that covers the subjects suggested by Ma et al. [5]. The result is summarized in Table 2.

Table 2. Converting the Academic Generic Skills Track to AI Track (ChatGPT 5.2)

An **AI track** leverages the academic generic skills track's embedded structure but focuses on competencies related to modern AI technologies, consistent with global curriculum guidance that integrates AI as a competency area in computing programmes.
Goals of an AI track may include:
- **AI literacy:** Understanding key concepts, limitations, and ethical implications of AI tools.
- Problem solving literacy:
- **Tool fluency:** Effective and responsible use of AI systems for coding support, analysis, or project augmentation.
- **System integration:** Applying AI methods within software and systems development contexts.
- **Problem-solving literacy:** Formulating problems, selecting appropriate AI techniques, and critically

interpreting AI-supported solutions in relation to the original task.
- **Ethical and societal reflection:** Interrogating the impacts of AI technologies on society, privacy, equity, and professional practice.

The AI track can progress across the bachelor programme as follows:
- **Year 1:** Exposure to basic AI concepts, awareness of ethical dimensions, and introductory AI tool usage in academic exercises.
- **Year 2:** Application of AI techniques in intermediate coursework and projects, with emphasis on integration into larger systems and critical evaluation.
- **Year 3:** Strategic use of AI in advanced projects and the thesis, accompanied by reflective components that assess professional, ethical, and societal implications.

The AI track at CS@HKR is still under development; however, its fundamental components were already implemented in Autumn 2024 in the first two courses of the first-year study programme, where students should learn basic knowledge and concepts of AI, the use of established generative AI tools, and ethical considerations. This study presents an overview of the first course, a description of the assignment, and students' experiences and reflections.

4. DA100D, Introduction to Computer Science, 7,5 HEC

DA100D is an initial course in the first year of the Software Development Bachelor Programme and serves as an entry point to both the discipline of computer science and academic studies [15]. The course provides students with a broad overview of fundamental computer science concepts while simultaneously introducing essential academic and scientific practices required for continued studies, which are a part of the academic generic skills track, including literature search and review, formulation of research questions, academic writing, referencing, and peer review. Students engage in both individual and group-based activities, allowing them to practice collaboration, communication, and reflective learning. Ethical considerations and the societal role of computer science are addressed throughout the course, with particular attention to sustainability and responsible software development, which are a part of the sustainable development track.

As part of the AI track, a new lecture on artificial intelligence has been introduced. This lecture provides students with an initial understanding of AI concepts and their relevance in computer science research and practice, as well as ethical aspects and a critical understanding of AI. The individual written assignment has been improved by applying the use of AI. Students practice academic writing both without and with AI-based tools. Through this assignment, students are required to reflect on their experiences, comparing the learning process, challenges, and outcomes of writing with and without AI support. This reflective component is designed to foster critical awareness of AI as a tool in academic and professional contexts.

The course consists of a combination of lectures, laboratory work, seminars, and formative assessments designed to support active learning and student engagement. By the end of the course, students are expected to have developed a foundational understanding of computer science, strengthened their academic generic skills, and gained an early, reflective perspective on the role of AI, ethics, and sustainability in the field.

Table 3 presents the description of an individual written assignment, which is a part of the examination of the following learning outcomes [15]:

"After completing the course, students must
– be able to search and locate information by using a computerized and Internet-based search system (7)
– be able to express themselves with a correct written language, use simpler concepts in the subject of computer science, and be able to follow accepted requirements for form, structure, and source references (8)
– be able to constructively analyze, evaluate, and criticize one's own and others' work (9)
– be able to make simpler assessments concerning relevant social and ethical aspects (10)."

Table 3. A description of an individual written assignment

Assignment overview
This assignment is composed of four parts and is a part of a pedagogical experiment. Therefore, it's important that you follow the instructions carefully. • Part 1: you will do the work by yourself (see description below). • Part 2: 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: 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: you will write a reflection on the experiment answering if you achieved the learning goals mentioned on the previous page (1 – 6)

Instructions:

1. Choose an interesting topic: Your topic should be related to "AI in research with a focus on SDG and Ethical Aspects."
2. Conduct your own research: Use databases like Google Scholar, available through the HKR Library home page, to search for trustworthy scientific articles and Internet sources. Do not use AI-tools for this part.
3. Read and analyze: Go through the articles and documents you find, and finalize your topic.
4. Formulate a research question: Find a research question based on your chosen topic. Again, avoid using AI-tools for assistance here.
5. Define a specific SDG: Select the SDG your research will focus on.
6. Discuss ethical aspects: Reflect on the ethical implications related to your chosen topic. Address potential ethical concerns, risks, or challenges associated with AI, particularly in relation to your SDG.
7. Write **Part 1:** Write a text on your topic according to the requirements described below without using AI-tools. Save this as Part 1.
8. AI-generated report (**Part 2**): Write a prompt to ask an AI-tool to generate a short academic report. Save this as Part 2.
9. Grammar/Language check (**Part 3**): After completing your text, ask an AI-tool (e.g. ChatGPT) to correct your grammar and language. Save this version as Part 3.
10. Write a reflection (**Part 4**): Reflect on your experience with the experiment. Consider the following questions:
    a. Using no AI-tool (Part 1): How did it feel to complete the work entirely on your own? What were the challenges and benefits of not relying on AI-tools for research and writing?
    b. Using and AI-tool (Parts 2 & 3): How did the AI-tool assist you? In what ways did it make the process easier or more difficult? Did the AI-generated content meet your expectations? Did the AI-tool generated references were correct? Is the level of language appropriate? Did you encounter any strange words that you would never use?
    c. Comparison: How did the quality and process of learning of your independent work (Part 1) compare with the work done using AI (Part 3)? What differences in thought process, creativity, or critical thinking did you notice?
    d. Ethical considerations: What ethical issues did you encounter during the use of AI in your research? How did you think AI impacts ethical decision-making in research?
    e. Research use: Do you believe your reflection on this experiment could contribute to broader research on AI in education? How might your experiences and thoughts be valuable in understanding the role of AI in academic settings?
    f. Agreement: Do you agree that your answers and reflections may be used anonymously for pedagogical research purposes?
11. Submit your report: Ensure you submit the full report before the deadline.
12. Peer review: After submission, you will be assigned a peer's report to review.
13. Participate in Seminar 2: Attend and actively participate in the seminar.

5. Results

Results are based on two years of experience reading and analyzing reports from more than 100 students per year. Students' reflections show the following:

a. Using no AI-tool (Part 1)

Students described completing the assignment without AI as initially challenging and time-consuming. Many reported frustrations at the early stages, particularly when formulating research questions. However, these challenges were also associated with clear benefits. Students emphasized that searching for sources manually improved their understanding of the topic and strengthened their ability to evaluate scientific literature critically. Several reflections indicated that writing without AI promoted deeper learning, greater ownership of the text, and improved awareness of academic structure and referencing practices.

b. Using an AI-tool (Parts 2 & 3)

When using AI tools for generating text and revising language, students consistently reported increased efficiency and improved grammatical correctness. AI was particularly appreciated for language refinement, sentence variation, and structural suggestions. However, several students noted

limitations. AI-generated references were sometimes incorrect or fabricated, and some outputs contained vague formulations or terminology they would not normally use. While AI often met expectations regarding structure and fluency, students observed that it occasionally lacked depth or precision.

c. Comparison between Independent and AI-Supported Work
In comparing Part 1 and Part 3, students generally perceived independent writing as more cognitively demanding but also more conducive to critical thinking and conceptual understanding. AI-supported writing was described as more efficient and linguistically polished but requiring careful oversight. Many students highlighted differences in thought processes: independent writing involved more deliberate reasoning and source engagement, whereas AI-supported writing involved evaluation, selection, and refinement of generated content. Overall, students characterized AI as a supportive assistant rather than a replacement for intellectual effort.

d. Ethical Considerations
Ethical reflections centered on concerns about fabricated references, misinformation, and overreliance on AI tools. Students recognized risks related to academic integrity, including uncritical acceptance of generated content and diminished personal responsibility. Privacy considerations were also mentioned, particularly regarding data sharing with AI platforms. At the same time, students acknowledged that responsible and transparent use of AI could support learning if combined with critical verification and ethical awareness. Many concluded that AI impacts ethical decision-making in research by increasing the need for vigilance, fact-checking, and explicit authorship responsibility.

Overall, students describe AI as a helpful assistant or companion that can support learning, but stress that human judgment, fact-checking, and personal responsibility for the quality and integrity of the work remain essential.

Below are some of the students´ reflections:

> “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.”

> “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.”

> “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.)”

6. Discussion

The thematic track model is designed to be structurally transferable by embedding theme-related competencies into selected existing courses. Introducing standalone modules tends to create additional administrative complexity and risks isolating the content from the core curriculum. Integrating the competencies progressively throughout the three-year programme makes the model adaptable across different institutional contexts and disciplinary settings.

The model does not rely on major curriculum reform, new degree structures, or additional credit-bearing courses. Instead, it operates through small, strategically designed adjustments within existing courses. We see that this makes it suitable as well for small as for large universities. Because implementation focuses on pedagogical design, institutions can adopt the model without significant administrative restructuring or resource expansion. Moreover, the SoTL-based approach ensures that adaptation can be locally evaluated and refined according to regulatory frameworks.

The model is not discipline-bound. The first thematic track implemented in the Computer Science programme was inspired by a similar track previously developed and successfully applied within the Economics programme at the same university.

If we consider, for example, the AI-track, its components are generic and adaptable, including AI literacy, critical evaluation of AI output, tool usage, ethical reflection, and progressive integration across the years of study.
For example:

- In Humanities: AI can be integrated into writing, textual analysis, and source criticism.
- In Engineering: AI tools can assist in design proposals, modeling, and simulation critique.
- In Health Sciences: AI can be used for evidence synthesis and diagnostic reasoning exercises with ethical reflection.

The model's strength lies in its low structural dependency, modular design, and pedagogical rather than technological core.

7. Conclusion

This study has demonstrated how small-scale changes in selected courses within a Computer Science Bachelor Programme can, in addition to strengthening disciplinary knowledge and skills, also promote key values and attitudes such as academic literacy, innovation, sustainable development, and AI-related competencies.

This study has also presented a small-scale, SoTL-informed intervention in a first-year *Introduction to Computer Science* course, where generative AI was introduced in the academic writing process. By assigning students an individual written report first without AI, then with AI support, and finally to reflect on the differences between the two approaches, the design fostered both academic writing skills and critical awareness of AI's role in learning. The intervention required only modest adjustments to an existing assignment, yet it opened rich opportunities for students to engage with AI in a reflective and ethically informed way.

Across two cohorts and more than 200 student reports, the results indicate that working without AI was often perceived as slower and more demanding, but also as more conducive to deep learning, source understanding, and critical thinking. In contrast, AI-supported writing was experienced as efficient and helpful for language and structure, while simultaneously exposing risks such as fabricated references, overreliance, and ethical concerns around honesty and authorship. Students consistently described AI as a useful assistant or companion, but emphasized that responsibility for accuracy, integrity, and understanding remained with them. Taken together, these findings suggest that carefully designed AI-supported activities can strengthen AI literacy, ethical reflection, and academic generic skills, while preserving the central role of human judgment in Computer Science education.

More broadly, the work illustrates how an emerging AI thematic track can build on the existing academic generic skills track model at CS@HKR: by embedding AI-related competencies - such as critical evaluation of AI output, responsible tool use, and reflection on societal impact - into strategically selected courses rather than introducing entirely new modules. In this way, the study

responds to external demands from industry and higher education authorities while maintaining coherence with programme-level learning outcomes and disciplinary depth.

8. Future Work

Future work will focus on extending this exploratory design beyond a single first-year course to additional courses and years within the Computer Science Bachelor's Programme, in line with the proposed AI track progression. This includes adapting similar "with and without AI" assignments to other contexts (e.g., programming, project work, and later-year courses) and examining how early experiences with AI as a writing companion influence students' practices in more advanced courses and, ultimately, in the bachelor's thesis.

From a research perspective, the next steps include a more systematic analysis of student reflections (e.g., thematic coding across cohorts), triangulation with additional data sources such as grades, rubrics, or surveys, and comparative studies between groups with and without AI-supported interventions. It would also be valuable to investigate teachers' perspectives on AI integration, develop clearer guidelines for AI use and authorship declarations across the programme, and explore how the AI track can be aligned with institutional quality work and accreditation requirements. In combination, these efforts can contribute to a more robust understanding of how AI can act as a constructive companion in Computer Science education - supporting learning, rather than substituting it.

Another interesting experiment with individual writing (with and without AI support) could be integrating AI as an "assistant supervisor", designed as follows:

- Students first write one paragraph on their own and then ask for an AI tool to evaluate whether the paragraph fulfils the given requirements (e.g., clarity, structure, use of sources, academic tone).
- Students then formulate one or more research questions and ask the AI tool to analyze and comment on the quality of these questions.

Table 4 presents an example of a writing assignment proposed by ChatGPT:

Table 4. Suggested extended experiment design (ChatGPT 5.2)

1. **Independent draft (no AI)**

– Students receive a short rubric (e.g. *clarity, relevance, academic tone, use of concepts*).
– They write a **short paragraph** and **1–2 research questions** *without* AI.

2. **AI as "Assistant supervisor"**

– Students paste their paragraph and research questions into an AI tool with a prompt like:
"Evaluate my paragraph and research questions according to this rubric: clarity, relevance, academic tone, and alignment with the assignment. Point out strengths and weaknesses, and suggest concrete improvements."
– They collect the AI's feedback but **do not accept it uncritically**.

3. **Revision based on AI feedback**

– Students revise their paragraph and/or research questions based on the AI's suggestions.
– They must decide which suggestions to accept, adapt, or reject, and be prepared to justify this.

4. **Short reflection**

– Students write 5–10 lines reflecting on:
  - What did the AI notice that I had missed?
  - Where was the AI's feedback useful, and where was it weak or misleading?
  - Did the AI help me better understand the rubric/requirements?
  - How did my own judgment differ from the AI's suggestions?

This way, AI is clearly framed as an **assisted supervisor**:

- not writing the text,
- but helping students *check* requirements, sharpen research questions, and become more aware of quality criteria—while still relying on their **own critical judgment**.

However, 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?

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