Handbook (re)design scientific writing.

What does AI mean for learning objectives, learning and instructional activities, and assessment?[1]

Content

1. Introduction

Generative AI is having a fundamental impact on how students write and how teachers assess writing skills. Whereas students used to learn to write primarily by practicing a lot, processing feedback and rewriting, they now have powerful language models such as ChatGPT, Copilot, writing assistants such as Deepl or Grammarly or other tools that can help them in every part of the writing process. This development offers opportunities and UM/FHML policy also allows programs to seize these opportunities, but it also raises questions: how do we still assess whether a text is truly a student's text? How do we ensure that students retain ownership of their work? And how can we use AI to enrich rather than undermine the teaching of writing? In a context with AI capabilities, it is no longer enough to give students a writing assignment and expect them to complete it independently. Research shows that, depending on their level of experience, students use generative AI in very different ways during writing [1]. Some students use AI to generate example sentences, rephrase sentences or make them more academic, while others ask AI to write a complete first draft. This variety requires explicit guidance in the writing process that allows for both experimentation and reflection. Rather than banning AI from writing instruction, it is more effective to teach students how to use it critically, ethically

[1] This guide was written by the FHML Working Group on AI and Education based on sources (see references), interviews and using ChatGPT 4.o. ChatGPT was used to structure texts in the five paragraphs and to get additional information on the topic. This English version is translated by Deepl.

and effectively. This requires adapted learning objectives, active and reflective forms of work, and forms of assessment that assess not only the final product but also the process.

This manual provides program, block and long line coordinators with tools to review their writing instructions in light of these developments. In doing so, we start from the premise that generative AI may be used in principle (see FHML AI in Education policy [4]), unless there are didactically sound reasons for not doing so. We do not want writing assignments in by invigilators monitored environments because writing is an iterative process that benefits from rewriting, reflecting, and seeking inspiration. A writing assignment in a fully supervised environment is inauthentic. Instead of banning the use of AI or controlling it with detection tools, we opt for transparency and didactic integration. Students must learn how to use AI critically, ethically and effectively, and teachers/tutors/mentors must discuss this use with their students and incorporate it integrally into their feedback processes and assessments.
The structure of this manual follows the three central elements of constructive alignment [5]: learning objectives, teaching activities and assessment. For each element, we indicate how the element can be evaluated in the context of genAI availability. Each section contains examples for this purpose, drawing on the work of Npuls[2] and others. Section 5 addresses the relationship between these elements to maintain constructive alignment.

2. Critically evaluating learning objectives.

Many learning objectives focus primarily on producing a final product in correct language and logical structure, but do not adequately consider the writing process itself or the cognitive skills needed to use AI responsibly. However, the final product is merely a product that follows a process of planning, organizing, knowing the target audience, setting goals, noting, reflecting, and adjusting (see Flower and Hayes' (1981) model [3]).

Therefore, a well-formulated learning objective not only focuses on the final text, but there are also learning objectives focused on the entire writing process; for example, students are able to:

- formulate a research question
- structure their thoughts,
- the writing process
- writing narratives,
- define the audience,
- Solicit, interpret and use feedback

[2] See https://npuls.nl/en/ai-and-data/

- reflect on the writing process
- Use generative AI consciously and effectively in the writing process.

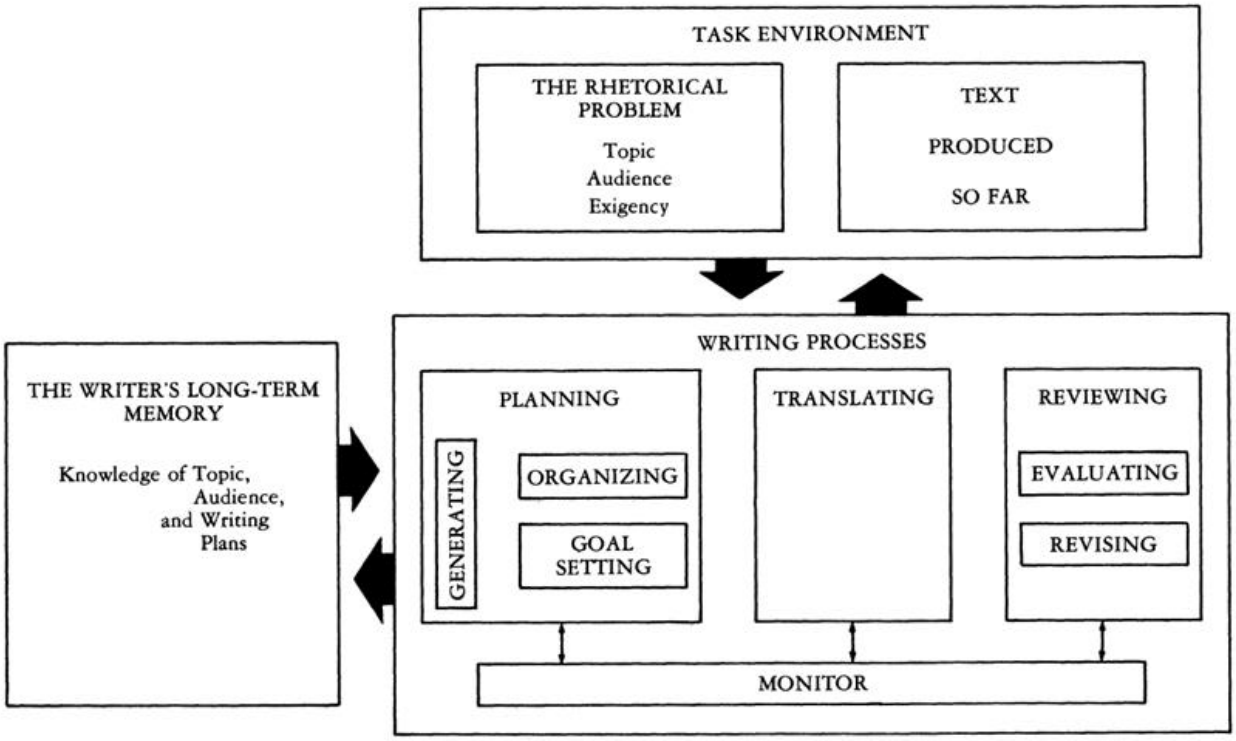

Figure 1. Writing model of Flower & Hayes (1981) [3].

Explicitly naming these learning objectives creates room for transparency and ownership. By adding AI prompts and reflections, it becomes possible for teachers to reconstruct what the student's contribution was, and what AI added, during assessment.

AI literacy is crucial here [2]: students need to gain basic knowledge of how AI works, understand its limitations, know how to use it, and know what ethical considerations are involved. This means that learning objectives should include digital literacy, critical thinking and ethical action. It is wise to keep in mind when constructing the curriculum that beginning writers (1e year) often still lack the critical skills to adequately assess AI output, and they may become discouraged if they find that AI writing is "better" [1]. Students with more experience are better able to use AI as a tool, for example, to improve structure, revise style, or incorporate feedback [1]. This difference in experience calls for learning objectives that promote both the writing process and metacognitive awareness regarding AI.

When revising learning objectives, it is therefore crucial not only to ask: "Can the student write a good text?" but also: "Can the student show how that text was created, and what role AI played in it?". This requires a shift from product-oriented to process-oriented assessment and learning objectives that do not prohibit the use of AI, but rather make it explicit and analyze it.

Examples of learning objectives:

- Students can use genAI tools effectively in brainstorming, structuring and revising texts.
- Students can reflect on the quality and reliability of AI-generated text.
- Students can recognize and distinguish their own writing style from AI-generated content.
- Students understand ethical implications of genAI use in writing assignments (such as plagiarism and transparency).

3. Critically evaluate and adjust instructional and learning activities

The teaching of writing stands or falls with well-conceived learning activities. An effective learning activity begins with making the writing process visible. Rather than prohibiting AI use, FHML has chosen to guide students in the responsible use of AI tools. This often begins with making explicit the writing strategies students use. Consider having them document prompts, having them save different text versions, and formulating reflection questions about why certain choices were made. In the Health Sciences writing line, students are guided through the process using concrete steps: first a rough draft, then rewriting with the help of AI, then evaluation, and finally reflection on the process. In the process, the use of genAI is not hidden away, but deliberately analyzed and discussed [6].

Thus, learning activities should not only focus on text production, but rather on skills such as critical thinking, evaluating AI output, and recognizing bias or unreliable information [1]. Students learn that AI is not a source of truth, but a language model that generates plausible sentences based on statistics, with no understanding of content. Therefore, they must learn to test AI texts against scientific sources, their own understanding and the requirements of the field. For this, the curriculum should include lectures and workshops that address this.

Examples of teaching activities (with genAI) that focus more on critical thinking:

- Use AI as a sparring partner by having AI texts generated and critically reflected upon in a group discussion.

- Have students explain how they used AI (e.g., prompt design, corrections, reasoning). Use questions such as: What did the AI get right/wrong in my first draft, Where did I adopt it and why, How did my process change? Learning reports, revision memos or self-assessment checklists can be used for this purpose.
- Peer feedback or peer (peer) dialogue with AI: Engaging in dialogue is crucial for critical thinking. Use AI tools to complement peer review to generate and evaluate feedback.
- Process-based writing instruction, where you deliberately divide instruction into steps: generate ideas, outline, draft, revise, edit.

An important insight is that students can become better writers when they compare their own texts with worked-out examples, especially when multiple variations are shown [7]. The AI output can be used for this purpose. Elaborated examples encourage awareness of style, structure and clarity. Repeatedly going through the process of rewriting with AI, evaluating the output, and making your own improvements can also contribute to deeper learning. In doing so, it helps to embed these steps in lessons or assignments, not just offer them as optional choices.

An active guiding role of tutors and mentors in this process is essential. They help students not only write, but also learn how to collaborate with AI: when it makes sense to use AI, when not, and how to make its use visible and accountable. Figure 1 provides insight into what this means for the role of mentor.

Figure 1. The role of the mentor in guiding students with AI.

Instructional and learning activities appropriate to this approach are thus process-oriented, iterative and reflective. They invite transparency about AI use and support students in developing writing skills in which AI is a tool, not a substitute. Dividing the writing process into steps, and teaching students to reflect on the use of AI in each step, creates room for growth, ownership and confidence in the final writing product.

4. Critically evaluate and adjust the review

Assessment in a context where AI has become available and commonplace requires rethinking what exactly we want to assess: the final product, the writing process, the writing skill, or the student's ability to use genAI responsibly (see learning objectives). Looking only at a final product encourages non-transparant genAI use. Instead, an assessment practice is desired that encourages transparency and explicitly includes the writing process in the assessment [1, 2].

One way to accomplish this is to work with process-oriented assignments. In these, students are asked not only to submit a text, but also to write an account of their writing

process, including the use of genAI. Such accountability includes, for example, the prompts used, an explanation of which genAI output was adopted and adapted, and especially a reflection on the added value of this use. This reflection is crucial. Students submit not only their text, but also an appendix explaining their use of tools such as ChatGPT or Grammarly, including the choices made and the trade-offs involved. Allowing generative AI and being transparent about how and what they used it for not only prevents unintentional fraud but also helps students better understand their own learning [2]. In addition, it is a basic attitude of academics to be transparent about practices followed. The reflective element makes assessment more meaningful and provides the instructor with clues to recognize the student's contribution to the work.

In addition, there are alternative forms of assessment that do not exclude genAI use, but rather integrate it into the learning process. It is important not to fall back on surveillance as the default solution [1, 2]. Surveilled writing assignments take away students' ability to rewrite, reflect and direct themselves. Rather, we see forms of assessment in which students make visible what their own contribution was, and how they used genAI consciously and critically. Designing prompts or comparing different genAI responses can also be a testable element. Oral explanations or presentations, logs of the writing process and formative feedback moments are valuable tools in this regard. In this sense, assessment becomes a means of understanding students' AI literacy, a competency that is becoming increasingly relevant

Examples for adapting the review:

- Make sure the assessment is not only about the final product, but also about the process and reflection during the process. Ask students (during the teaching process) to reflect on the role of AI in their writing process: what worked well, what didn't, what would they do differently?
- Have students document their writing process, including the use of AI (think logs, versions, prompt annotations).
- Have students verbally explain their choices to assess ownership of the text.
- Add assessment criteria to a rubric on the critical use of AI, ethical awareness, and writing skills with and without tools. An example for this was created at the A-KO master's (JW Voncken; see Figure 2).

13. Reflectie (gen)AI gebruik/ Reflection (gen)AI use			
O./insufficient	**T./dubious**	**V./sufficient**	**G./good**
Major revisions required with respect to multiple aspects below. Awareness of AI's role in writing: Poor acknowledgment and/or awareness of the impact and/or value of AI use on writing. Evaluation of AI-generated content: AI-generated text, ideas, or sources are uncritically accepted without verification. Ethical and responsible AI use: Apparent reliance on AI-use without transparency and differentiation of original work from AI-input. Impact AI on learning and thinking: Reflection on impact of AI-use on learning, critical thinking and academic development largely missing/ insufficient. Transparency: Justification AI-use (*in an annex*) is minimal and/or vague regarding tools, purpose and application.	Improvement required on any of the aspects below. Awareness of AI's role in writing: AI use acknowledged, but limited explanation provided on impact AI in the research/ writing process. Evaluation of AI-generated content: Potential for biases or error recognized, but AI-generated content not consistently verified. Ethical and responsible AI use: AI use acknowledged, but limited clarity provided in attribution AI-generated content. Impact AI on learning and thinking: Basic reflection on impact AI-use on development critical thinking and academic development requires depth/ insight. Transparency: Justification AI-use (*in an annex*) would benefit from additional explanation and detail regarding tools, purpose and application.	**Awareness of AI's role in writing:** Sufficient recognition of the role of AI-use in shaping structure, coherence and argumentation of the text; impact AI-use adequately explained. **Evaluation of AI-generated content:** Sufficient evaluation of AI-generated output for bias, accuracy, relevance; necessary edits to improve or correct the content are made. **Ethical and responsible AI use:** Sufficient adherence to basic ethical guidelines, AI assistance is explicitly acknowledged or attributed (*where relevant*). **Impact AI on learning and thinking:** Basic reflection on the effects of AI-use on the learning process, including: development of critical thinking, academic writing and on the significance of 'own work'. **Transparency:** Justification AI-use (*in an annex*) is explicit, regarding tools, purpose and application. Overall, the student demonstrates a basic and responsible approach to the use of (gen)AI in the writing process. Minor improvements/ adjustments are possible in any of the aspects above.	Awareness of AI's role in writing: Insightful demonstration of recognition and critical reflection on the value and limitations of AI-use throughout at various stages of the writing process. Evaluation of AI-generated content: AI-generated output is rigorously reviewed for accuracy, bias and relevance. AI-output is cross-checked against credible sources and fully justified. Ethical and responsible AI use: Clear distinction between own and AI-generated content; good reflection on ethical boundaries of AI-use, including: *(i.a.)* authorship, transparency and academic integrity. Impact AI on learning and thinking: Nuanced reflection on long-term effect of AI-use on critical thinking, creativity, academic integrity and independent academic development; the significance of 'own work'. Transparency: Justification AI-use (*in an annex*) is explicit, regarding tools, purpose and application. Overall, the student demonstrates critical awareness and ethical maturity in the use of (gen)AI in academic writing. Reflective performance does not need improvements/ adjustments.

Figure 2. Rubric for responsible use of AI

5. Checking constructive alignment

If learning objectives, learning activities or assessment are modified, it is important to check whether constructive alignment still exists. Only when these three components are in balance can we ask students to be transparent and critical about genAI use during writing, as well as confident that the final product is truly the result of their own learning

When generative AI plays a role in education, it affects each of these components. A learning objective that encourages critical genAI use requires different learning activities than a learning objective that assesses purely text production. Similarly, a test that demands reflection on genAI use requires instructional activities in which students practice arguing their choices. Adapting only one component without including the rest creates friction in the curriculum.

As a program or teaching team, it is advisable to periodically reflect on the alignment between goals, activities and testing. A simple way to do this is with an alignment table in which you name which activities contribute to each learning objective and how it is tested. These tables are included in the assessment plan. For example, if a learning objective is about assessing genAI output for academic style and content, there should be a learning activity in which students practice that (such as a comparative analysis), and a test in which that is also evaluated (such as a reflection report or peer review). This assessment

can be either formative or summative. For each course, make visible how genAI may be used. Use the example described in Appendix 1 for this purpose.

Finally, constructive alignment in genAI times also requires rethinking the vision behind the teaching of writing. Is it about being able to write correct texts, or about developing thinking skills, argumentation and ownership over language use? This fundamental question determines all choices in curriculum design. When the vision is clear, learning objectives, teaching activities and assessment can be shaped in coherence, and space is created for the responsible and valuable use of generative AI.

Case study: The writing line at the undergraduate Health Sciences program

The writing component of the undergraduate health sciences program focuses on the writing process. Writing is approached here as an iterative, reflective and creative process, in which students shape their thinking, structure and focus on a concrete audience. Within this context, generative AI now plays an important supporting role. The program has chosen not to exclude this technology, but rather to integrate it into the learning process. A manual is available for thesis supervisors [8], which consists of a description of the supervisor's responsibilities (in supervision and assessment), suggestions for the structure of supervision meetings, and several forms: Academic conduct confirmation form, AI prompt history reflection form, examples of responsible use of GenAI in thesis supervision and a rubric for critical reflections on the use or non-use of GenAI.

The premise is that generative AI, if used deliberately, can help students build argumentation, formulate research questions, structure text and rewrite draft versions. For example, students learn how to create a first draft introduction, then employ genAI to get suggestions for improvements in structure, wording or logical construction. In doing so, they are encouraged to use specific prompts: the more concrete the input, the more useful the output of the genAI tool. The training guides them step by step in this process (see Figure 4): from writing a first draft, through genAI use and evaluation of the generated text, to a reflection on the result.

Figure 4. Overview of the steps in the writing process [6].

An essential part of this approach is the evaluation phase. Students are taught to look critically at what genAI provides them. They check for accuracy, for logic and clarity of structure, for style and tone, and for any bias or inaccuracies. They reflect on what they themselves contribute and what genAI has provided. That reflection also becomes part of the assessment: in an appendix to their writing assignment, students document how they worked with genAI, what prompts they used, and what they learned from it.

This process is embedded in the broader didactic framework of the writing line, which works with constructive alignment between learning objectives, instructional activities and assessment. The learning objectives have been rewritten to make the writing process and the use of genAI explicit. Students learn not only to produce texts, but also to structure their thinking process, choose an appropriate structure, address the appropriate audience, solicit and process feedback, and reflect on their own learning. Generative AI is thereby considered a didactic tool, not a threat.

Moreover, the program stresses the importance of integrity. Plagiarism, i.e. copying pieces, thoughts, reasoning of others and passing them off as one's own work, obviously remains unacceptable, and in case of doubt an examination board will be consulted. Here it is important to realize that texts written by AI based on a student's prompt are considered to be the student's text. But genAI use is not seen as a problem by the program per se, as long as it is done transparently and responsibly. Students learn how to ensure that transparency, including through attachments with reflections, prompt history and source references.

At its core, the premise is that GenAI does not take over the writing process; The writing remains the student's. GenAI can, however, be a co-writer: a sparring partner, a source of suggestions, a tool for revision and enrichment. Designing the teaching of writing in this way creates space for creativity, ownership and depth. Thus, writing remains a skill rooted

in critical thinking and personal expression, even at a time when technology is playing an ever-increasing role.

References

[1] The Guardian et al (2024). Responsible deployment of GenAI in academic writing instruction: an illusion? [Verantwoord inzetten van GenAI in het academisch schrijfonderwijs: een illusie?]. Colloquium. KU Leuven

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[3] Flower, L., & Hayes, J. R. (1981). A Cognitive Process Theory of Writing. College Composition and Communication, 32(4), 365-387. https://doi.org/10.2307/356600licy AI in Education

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[7] Kyun, S., Kalyuga, S., & Sweller, J. (2013). The Effect of Worked Examples When Learning to Write Essays in English Literature. The Journal of Experimental Education, 81(3), 385-408. https://doi.org/10.1080/00220973.2012.727884

[8] Roebertson, H. (2025). Bachelor thesis guidelines for thesis supervisors. Maastricht: UM

Appendix 1. Inclusion in course syllabus.

Using GenAI Tools in [COURSE NAME.

Nowadays, various GenAI tools and resources are available online and offline that help users to formulate, revise, and restructure texts and ideas. Common examples include ChatGPT, Perplexity, Google Gemini, Microsoft Copilot, DeepL, Quillbot, InstaText, Scribbr and Grammarly. Because this course aims to assess your personal cognitive skills and subject knowledge, except where the course materials specifically say so, *do not use GenAI tools* in the following ways

- Don't present as your own work anything generated or restructured by GenAI tools
- Don't use AI generated content in any way that the grader *might believe* it is your own work, or that might prevent the grader from deciding if you personally have learned what is to be learned in this course

The table below explains the ways in which this course allows you to use GenAI tools, as well as ways that are not permitted. Where GenAI use is permitted in certain teaching and/or assessment activities (see table below), you must always explain

- Exactly *what* GenAI material you inserted in your paper and *why* you did so.
- *How* that material was generated (including the prompts you used)
- *If and how* you modified the GenAI content
- *If and how* you used GenAI to modify your own content

This information should be made available upon request by the course coordinator or your tutor. Correct procedure for citing legitimate GenAI use is provided in the FASoS Writing Guide

GenAI use

In this course, use of GenAI to..	**For assessment**	**For assessment**	**For assessment**
help with outline/structure of the	Choose an item.	Choose an item.	Choose an item.
check spelling and	Choose an item.	Choose an item.	Choose an item.
rephrase your work or change your	Choose an item.	Choose an item.	Choose an item.
translate between	Choose an item.	Choose an item.	Choose an item.
help write and format your reference	Choose an item.	Choose an item.	Choose an item.
identify sources relevant to your	Choose an item.	Choose an item.	Choose an item.
get initial information about a	Choose an item.	Choose an item.	Choose an item.
brainstorm and evaluate own ideas, for alternative perspectives or	Choose an item.	Choose an item.	Choose an item.
explain and deepen the understanding of	Choose an item.	Choose an item.	Choose an item.
help with programming software code, algorithm development, and	Choose an item.	Choose an item.	Choose an item.

gain insights from complex datasets.	Choose an item.	Choose an item.	Choose an item.
create multimedia content, e.g., images, videos, animations, or audio (but always explain that you have used AI tools	Choose an item.	Choose an item.	Choose an item.

✓ = GenAI use is

✕ = GenAI use is not allowed, breaches will result in

n.a. = not applicable for this

***Attention:** That a certain practice is *allowed* does not mean that you are *expected* to use GenAI for this assessment. In many situations, more appropriate or effective tools exist, and/or you will likely produce better results without using GenAI.