



# Fostering Critical AI Literacy in STEM Education

*A Co-Design Approach to Developing  
Vision Documents and Workshops*

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# Introduction - Data-driven systems and LLM

## Data-driven systems



## Large Language models - Stochastic parrots



Meta

**Llama 3**

# Introduction - Impact of genAI in the University

## Concerns

- Preservation of academic integrity
- Relevance of the learning objectives
- Integration of AI tools into learning and teaching
- Development of students skills on how to use genAI tools

## Reactions

- New guidelines that range from banning to embracing
- Emerging innovations from teachers training chatbots for specific contents
- Universities purchasing genAI technologies according to their policies
- Revision of assessment protocols to prevent fraud

## Goal

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**To develop the necessary guidelines, training and resources to support university educators from the Faculty of Science and Engineering to make a critical selection and use of genAI tools for educational purposes**

# Premises - Combining research with embedded expertise

**1. Develop a research informed document that bring a vision on how critical use of AI is conceived**

- Using current guidelines from UNESCO and European commission
- Using available educational research on conceptualisations of AI literacy
- Bringing internal expertise from European projects (MAMMOth, INFINITE, etc.)

**2. Develop a design-based iterative approach where different university stakeholders bring their perspectives and expertise.**

- Following a bottom-up approach
- Inviting STEM lecturers, students, experts on AI and programme managers
- Starting from real-case scenarios of our university

# A framework for critical AI literacy

## Defining critical AI literacy

- Framed in feminist and culturally responsive pedagogies
- AI tools designed from a human-centred perspective
- Putting the ethical debate upfront

- 1. What is the nature of knowledge produced through generative and predictive AI?*
- 2. Whose knowledge is it?*
- 3. Who benefits from AI?*
- 4. Based on what data are algorithms made available?*
- 5. Can we afford the environmental impact of AI?*
- 6. Who is held accountable when AI systems fail?*

# A vision for the Faculty - Design process (29 nov 2023)

- Introduced the project goals
- Presented current context on AI regulation and research
- Engaged on a feedback activity based on real cases



Responses

Traditionally, we divide teaching in to learning and assessment. But if we can follow the learning closely enough, it may make assessment unnecessary.

Transparency without immediate judgement on the use of AI tools helps to create an atmosphere of trust

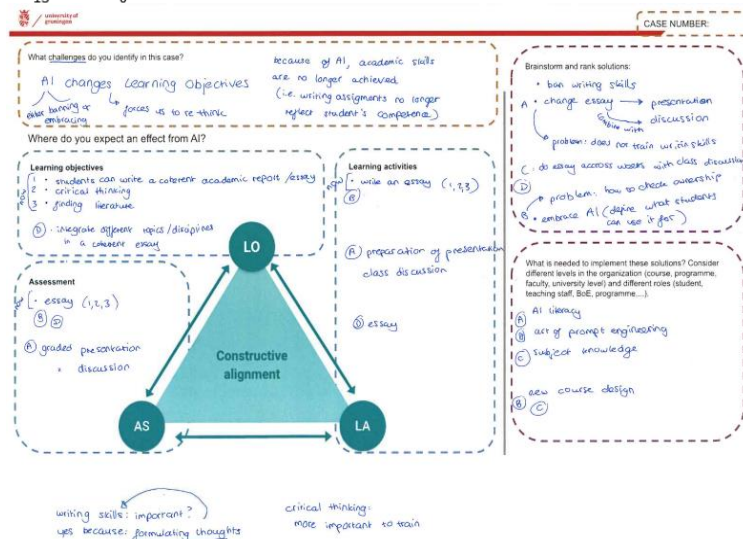
Upvotes Downvotes

15

Responses

13

0



# A vision for the Faculty - Design process



## What is AI Literacy? Competencies and Design Considerations

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## AI Literacy: Definition, Teaching, Evaluation and Ethical Issues

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Input from other  
AI working groups,  
conferences, etc.

## FSE AI in education - policy

### Introduction: GenAI in Education at FSE

Background and context for the policy

- Developments in generative AI are going at a fast pace
- Implications for learning and thus for education
- Need for a faculty vision on the role and use of AI in education
- There should be room for differences between programmes and courses

### Purpose of this document

- Vision statement at the faculty level on the role and use of AI in education, containing values and guiding principles
- Provide clarity on the ways genAI can be used
- Defining the responsibilities of different actors in the organisation with respect to AI in education

This is a dynamic document, which will be adapted to the (anticipated) developments in the world of AI in the coming years

Something or complementarity with UG guidelines and programme guidelines? Or should this be in the roles and responsibilities paragraph?

### Definitions

- Key definitions around recurrent concepts appearing in this document are delimited by the following definitions
- Artificial intelligence (AI)** systems are software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, integrating the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best actions to take to achieve the given goal. AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behaviour by analysing how the environment is affected by their previous actions. (Definition provided by the European commission)
  - Generative AI**: Generative Artificial Intelligence (AI) refers to a subset of machine learning techniques and models designed to generate data, content, or information.



## SB1 input

Centre for learning  
and teaching

The use of generative AI in education at FSE - Policy and vision document	
Introduction	2
Vision	2
Towards AI literacy at FSE	2
Values	3
Design principles	4
Shifting the focus from product to process in assessment	4
The use of genAI should be aligned with the Learning Objectives (LOs) of the course	5
UG guidelines	5
FSE practices and initiatives	6
Consulted references	7

First AI vision draft

Shared AI vision draft



# A vision for the Faculty - Design process

40 minutes to:

1. Write your programmes and roles
2. Quickly review the draft
3. Discuss and provide feedback on the canvas
4. Some extra questions to foster discussion behind

Share 2 take away reflections for the final discussion

	Feedback
Introduction	
Vision	
Towards AI literacy at FSE	
Values	
Design principles	
Shifting the focus from product to process in assessment	
The use of genAI should be aligned with the Learning Objectives (LOs) of the course	
UG guidelines	<i>They will be shared soon.</i>
FSE practices and initiatives	
Overall text, general feedback	

# FSE AI Literacy Vision Document



university of  
 groningen

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## FSE AI Literacy Vision Document

27 June 2024

In October 2023, the CLT initiated an effort to formulate a vision for AI in education at FSE. The response from the FSE community was remarkable, with 33 individuals, including 6 student representatives from programme boards, joining the sounding board, representing all 6 FSE education clusters and 8 of our research institutes. A complete list of all sounding board participants can be found below.



# Critical AI literacy definition

*The set of competences that integrate:*

- *the application of Science, Engineering and Mathematics disciplinary knowledge, practices and values;*
  - *knowledge about the nature of the AI; and*
  - *the self awareness of personal, social and professional values*
- to enable students and instructors to evaluate, communicate and collaborate with AI technologies in a critical and reflective manner.*

# Operativisation of the definition

This definition is operationalised as:

- Developing technical knowledge on genAI systems that allows understanding on how data is processed and retrieved. This knowledge should not be dependent on extensive knowledge of coding skills or mathematics.
- Evaluating the impact of AI systems in academic activities balancing its strengths and dangers at different levels:
  - a. Impact on the **ways of performing scientific research and educational activities** (accountability, need of new protocols and tasks, establishing clear roles etc.).
  - b. Impact of **using AI tools** with their specific architecture and training dataset (biases, output limitations, etc),
  - c. Impact of **collaborating with specific AI providers** (data protection, values of the provider, accountability of the provider).
  - d. **Impact on human interactions** (which new dynamics will be fostered, student-teacher interactions)
  - e. Impact on **social, political, economic and cultural spheres** (which practises as an institution we want to reinforce or prevent).

# A vision based on FATE values

- **Fairness.** genAI tools can reproduce prejudice and unfairness consciously or unconsciously.
- **Accountability.** the use of genAI tools demands efforts to determine shared accountabilities.
- **Transparency.** GenAI tools should allow students to be in control of their data and make informed choices about how their data is used. Students should also be explicit about the usage, and credit of the genAI tools.
- **Critical & Ethical use.** FSE members are expected to keep an informed and critical utilisation of the outputs generated by genAI and require spaces for further critical questioning of genAI tools in their fields.

Table 1: Comparison of Data and AI Ethics<sup>6</sup>

Ethics Guidelines for Trustworthy Artificial Intelligence by the European Commission	German Commission on Data Ethics	IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems
2. Technical Robustness and Safety	4. Security	
3. Privacy and Data Governance	3. Privacy	
4. Transparency		5. Transparency
5. Diversity, non-discrimination and fairness	6. Justice and Solidarity	
6. Societal and environmental wellbeing		2. Wellbeing
7. Accountability		6. Accountability
	1. Human Dignity	1. Human Rights
	2. Self-determination	
	5. Democracy	
	7. Sustainability	
1. Human Agency and Oversight		3. Data Agency
		4. Effectiveness
		7. Awareness of Misuse
		8. Competence

Note: The numbering reflects the rank order in the respective set of guidelines.

<sup>6</sup> Sources for table: “The Ethics Guidelines for Trustworthy Artificial Intelligence” by the European Commission (*Ethics guidelines for trustworthy AI*, 2019); report by the German Commission on Data Ethics (German Data Commission, 2019); IEEE publication on “Ethically Aligned Design” (IEEE, 2017). Cited by Köbis & Mehner, 2021.

# Next steps

## Unfolding the vision into guidelines and training

1. Design and implement a professional development training based on the FSE AI vision for critical AI literacy for lecturers
1. Provide guidelines to programme boards on the critical selection and use of AI tools for educational purposes.

# Workshop example - Designing lessons through AI



Where and how is the interaction?



Questions based on 'packed' definitions.

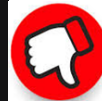
## Main Activity (1 hour 30 minutes):

### 1. Interactive lecture (30 minutes):

- Introduce a few key categories of new molecular biology tools recently developed (e.g., CRISPR-Cas systems, next-generation sequencing, RNA interference (RNAi)).
- Briefly explain the underlying principles of each tool and showcase animations or short videos to illustrate the processes.
- Use clear, concise language and avoid excessive technical jargon.
- **Example questions:**
  - What is the basic concept behind the CRISPR-Cas system?
  - How does next-generation sequencing differ from traditional Sanger sequencing?



Introduces the idea that the class should be interactive



Keeps a traditional perspective of education and lectures.

# Workshop example - Preliminary conclusions

- AI tools can hide traditional approaches of learning behind formal educational vocabulary.
- Generating high quality instructional designs is a complex endeavour that requires different perspectives and preparation.
- AI tools can decide what to teach with any reasoning.
- AI tools bring an opportunity to rethink about didactical aspects (why, what and how am I teaching this).



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**Thank you for your time**