UNIVERSITY OF CALGARY
Student Success Centre

AI Literacy and Critical Thinking

Having AI literacy doesn't necessarily mean that you need to understand the deeper mechanisms of generative artificial intelligence (Gen AI) systems, but you should have a good idea of how AI generates outputs, as well as a growing knowledge of AI's capabilities, limitations, and ethical implications. This level of understanding helps you better evaluate generative AI and its output, enabling you to safely and ethically use these tools. This handout provides an overview of some important considerations for developing AI literacy.

How does Generative AI Work?

Most Gen AI tools use predictive modeling. To "understand" words, text-based Gen AI models use large amounts of data to learn specific patterns that appear in texts about any specific topic. This process allows the AI system to assign a statistical "meaning" to any given word based on words that appear alongside it.

When you use a Gen AI tool like ChatGPT or Copilot Chat, the model can calculate the meaning of each word by taking into account the context in which the words appear. After analyzing your prompt, the Gen AI tool generates a response by statistically predicting the best set of words to use.

Gen AI tools also include image generators, which use large numbers of images to learn about the relationships between shapes, objects, colours, and so on. Similarly, audio and video generators use large amounts of audio and video data. These tools recognize recurring patterns in text, sound, and images, as well as the relationships between concepts, words, shapes, sizes, textures, noise, and frequencies to generate text, images, video, or audio.

What are the Limitations of Generative Artificial Intelligence?

Bias

Gen AI must be trained on data. This is a process that almost inevitably introduces biases. Although Gen AI datasets are large, if the process of data collection lacks diversity, the AI can reflect this lack of diversity in its output.

Additionally, many Gen AI tools are trained on texts that are widely available. As a result, the tools will echo the biases present in their training data (The University of Kansas, 2024).

Companies can implement filters to prevent generating discriminatory outputs, but the risk of bias cannot be fully mitigated because of the existing bias in the training data.

Hallucinations

Gen AI tools use predictive modeling to generate a response. Sometimes, their statistical calculations lead to wrong answers. As a result, they "make stuff up."

Since many AI tools are trained on just about anything that can be freely found online, they can even repeat fabricated information or satirical content, convincingly presenting these as facts.

Misinformation and disinformation

False information has been a problem throughout human history, and media technologies have more recently been facilitating the spread of "fake news."

With today's AI tools, we are even more susceptible to consuming misinformation. AI tools not only spread misinformation—unintentional inaccuracies—but they also make it easier for malicious actors to fabricate and spread misinformation.

AI's Impact on Critical Thinking

Studies regarding Gen AI's cognitive implications suggest that over-reliance on AI tools can lead to reduced engagement with the material, potentially diminishing the critical and analytical skills necessary for academic and professional success (Gelrich, 2025; Kosmyna et al., 2025).

If Gen AI users do not apply critical thinking skills to the evaluation of AI output, users might internalize AI hallucinations or AI-enabled misinformation and eventually reiterate inaccurate information. Additionally, since most AI systems are trained on content with inherent human biases, AI-generated outputs can amplify those biases (Nicoletti, 2023; The University of Kansas, 2024).

Critical thinking and human judgment are keys to harness AI's potential. Kosmyna et al. (2025) found that using AI tools to help with the process of revising essays can increase brain engagement. By using AI tools to reinforce your understanding of a topic, you avoid delegating cognitive work. Instead, you start to engage with this information interactively. This indicates AI's potential to help develop our own critical thinking, rather than hinder it.

Is AI Good for Education?

Gen AI is particularly good at synthesizing data to personalize education, adapting to a student's learning style (Walter, 2024). This, in turn, can help students to actively engage with the learning process instead of being stuck in a rote process of memorization and regurgitation.

Simply put, Gen AI can act like a teacher or a friend with infinite patience, always willing to adapt to a student's pace to help them understand any topic. Gen AI can effectively offload some of the mental burden that can come with the learning process. However, AI's ability to do a lot of the intellectual heavy-lifting may also hinder development of personal skillsets.

When using AI tools, you should use the technology to promote your own critical thinking rather than to offload cognitive work. Relying on AI tools to do the work for you will diminish the critical engagement required to learn and retain information. For instance, using AI to

synthesize information and write an essay for you will likely diminish your learning and personal growth. In other words, delegating most of the cognitive work (i.e. reading, analyzing, translating, and writing) to the AI will negatively affect your own ability to understand the topic.

Instead, consider using AI tools to help you further interrogate arguments and reinforce your understanding of the topic. You can use AI to help look for plausible counterarguments, gaps and limitations in your essays and projects, as well as possible areas of further research.

You may also consider using AI tools to summarize text you already know well, which can introduce other insights you may not have seen before. Moreover, since you already have a solid understanding of the text in question, you may be able to spot Gen AI's mistakes and limitations. When you fact-check Gen AI's output and actively look for these errors, you engage with the text on a closer, more critical level (Steele, 2023).

Conclusion

Although Gen AI promises efficiency, it has many challenges and limitations. Proper evaluation of AI outputs is necessary with every use. Check for reliability and consult other sources. Remember: It is good practice to be skeptical of AI-generated outputs.

References

Gerlich, M. (2025). AI tools in society: Impacts on cognitive offloading and the future of critical thinking. *Societies*, *15*(1), 6. https://doi.org/10.3390/soc15010006

Kosmyna, N., Hauptmann, E., Yuan, Y.T., Situ, J., Liao, X., Beresnitzky, A.V., Braunstein, I., & Maes, P. (2025). Your brain on ChatGPT: Accumulation of cognitive debt when using an AI assistant for essay writing task. *ArXiv Preprint.* https://doi.org/10.48550/arXiv.2506.08872

Nicoletti, L . & Bass, D. (2023, June 9). *Humans are biased. Generative AI is even worse.* Bloomberg. https://www.bloomberg.com/graphics/2023-generative-ai-bias/

Steele, J. L. (2023). To GPT or not GPT? Empowering our students to learn with AI. *Computers and Education: Artificial Intelligence, 5*, Article 100160. https://doi.org/10.1016/j.caeai.2023.100160

The University of Kansas. (2024, March). *Helping students understand the biases in generative AI*. Retrieved June 25, 2025, from https://cte.ku.edu/addressing-bias-ai

Walter, Y. (2024). Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education. *International Journal of Educational Technology in Higher Education*, *21*(1), Article 15. https://doi.org/10.1186/s41239-024-00448-3