

# Generative AI for Critical Analysis: Practical Tools, Cognitive Offloading and Human Agency

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## ABSTRACT

Generative artificial intelligence (GenAI) is now capable of performing tasks that we have considered intellectually demanding. There are justified concerns that this will undermine the agency of both educators and students, if tools are poorly designed, poorly used, or imposed — with consequences for education and the future of work. This short paper contributes practical examples pointing the potential for GenAI to promote critical analysis as part of intellectually demanding tasks, by both students and educators. However, this depends on appropriate usage. The paper then briefly discusses how we may balance the benefits and risks of human cognitive offloading to AI, as a perspective on human agency.

## Keywords

Generative AI, critical thinking, agency, cognitive offloading

## 1. Introduction

There are diverse intelligences and dispositions that we need to cultivate in citizens and students, to equip them for the challenges now confronting society [1-3]. One that persists in all lists of ‘21<sup>st</sup> century skills’ is critical thinking/analysis. One general form that this takes in formal education is the capacity to understand, critique and formulate arguments, which transfers into knowledge work in the workplace. In this paper, I describe how GenAI apps offer new capability in this regard, reporting on tests I have conducted as a continuation of several decades’ research into argument visualisation [4-6]. I then describe a second form of critical analysis, namely, distilling a body of ideas into a more succinct summary, the example being the clear articulation of university course learning outcomes. These examples help to demonstrate what AI can now do, which until recently we considered the preserve of humans. This invites a discussion of how we balance the benefits and risks of human cognitive offloading to AI, as a perspective on the broader question of human agency in future human/AI systems.

## 2. Critical thinking through argument analysis


### 2.1. Example 1: Identifying the implicit premises in an argument


Arguments are being made constantly in everyday public discourse, as well as within academia. We aspire for citizens to be able to make robust arguments, as well as critique them appropriately. In the philosophy of argumentation, the recurring types of argument have been taxonomized into a robust set of “Argumentation Schemes” [7]. OpenAI’s GPT-4 is a sophisticated aid to analysing everyday arguments, as illustrated in Figure 1.

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**You**  
Please can you identify the unstated premises in this argument: We must reduce global warming as soon as possible, because the UN Panel on Climate Change has recommended this.

**ChatGPT**  
The argument presented has a couple of unstated premises that are implicit in the reasoning. These unstated premises are assumptions that the argument takes for granted in order to reach its conclusion. They include:

- The UN Panel on Climate Change is a Reliable and Authoritative Source:** This premise assumes that the recommendations made by the UN Panel on Climate Change are based on accurate, reliable, and comprehensive scientific data and analysis. It suggests that their expertise and findings are trustworthy enough to act upon.
- Recommendations from an Authoritative Source Should be Followed:** This premise assumes that if a reputable body like the UN Panel on Climate Change makes a recommendation, it is prudent and necessary to follow that recommendation. It implies that their advice is not only credible but also practically and ethically important to heed.
- Actions to Reduce Global Warming are Feasible and Effective:** Implicit in the statement is the assumption that it is possible to take effective actions to reduce global warming and that these actions will have a meaningful impact on mitigating climate change.
- Urgency in Addressing Global Warming is Justified:** This premise assumes that there is a pressing need to act against global warming immediately. It implies that delaying action could lead to more severe or irreversible consequences.

By identifying these unstated premises, one can better understand the underlying assumptions that support the argument's conclusion.

**You**  
What kind of argument is this?

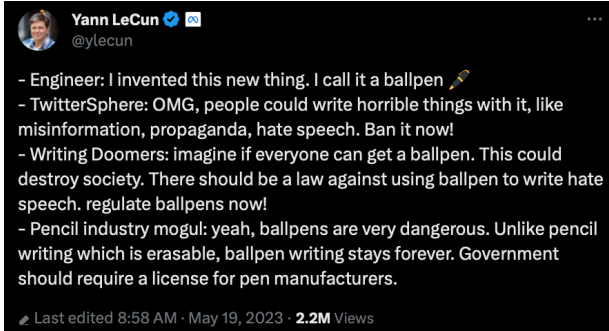
**ChatGPT**  
The argument presented is an example of an "argument from authority." This type of argument relies on the authority, expertise, or credibility of a source to support its conclusion. In this case, the argument is based on the recommendation of the UN Panel on Climate Change, which is presumed to be a credible and authoritative body in matters related to climate science.

Arguments from authority are common and can be quite persuasive, especially when the authority cited is widely recognized as expert and trustworthy in the relevant field. However, the strength of such arguments depends on:

- The Authority's Expertise:** How knowledgeable and expert is the authority in the specific area under discussion?
- The Authority's Credibility:** Is the authority reliable, unbiased, and trustworthy?
- Relevance of the Authority's Expertise to the Argument:** Is the area of expertise of the authority directly relevant to the argument's subject matter?
- Consensus Among Other Experts:** Does the view of the authority align with the consensus in the field, or is it a minority or controversial position?

When evaluating an argument from authority, it's important to consider these aspects to determine its validity and strength. Arguments from authority can be weak if the authority is not actually an expert in the relevant field, if they are biased, or if their opinion does not reflect the consensus view among other experts.

Figure 1: OpenAI's GPT-4 as an argument analyst. (Left) Analyse the implicit premises in the argument "We must reduce global warming as soon as possible, because the UN Panel on Climate Change has recommended this." (Right) It correctly classifies this as an *argument from authority*, whose weight rests on specific premises that can be substantiated/attacked.



**Yann LeCun** @ylecun  
- Engineer: I invented this new thing. I call it a ballpen  
- TwitterSphere: OMG, people could write horrible things with it, like misinformation, propaganda, hate speech. Ban it now!  
- Writing Doomers: imagine if everyone can get a ballpen. This could destroy society. There should be a law against using ballpen to write hate speech. regulate ballpens now!  
- Pencil industry mogul: yeah, ballpens are very dangerous. Unlike pencil writing which is erasable, ballpen writing stays forever. Government should require a license for pen manufacturers.

Last edited 8:58 AM · May 19, 2023 · 2.2M Views

**Correct.** The analogy is between the pencil, and generative AI. According to Walton, what critical questions can we ask about such an argument?

According to Walton's Argumentation Schemes, there are several critical questions that can be asked to evaluate an argument by analogy. These include:

- Are there significant similarities between the two things being compared (in this case, the pencil and generative AI)?
- Are there significant differences between the two things being compared that would undermine the analogy?
- Is there a better analogy that could be used to make the same point?
- Is the conclusion drawn from the analogy reasonable and well-supported?

By asking these questions, we can evaluate the strength of Yann LeCun's argument and determine whether his analogy is effective in making his point.

10 of 20

Please answer those questions in detail.

Sure. Here are detailed answers to the critical questions for evaluating an argument by analogy:

- Are there significant similarities between the two things being compared (in this case, the pencil and generative AI)?

It is not immediately clear what significant similarities there are between a pencil and generative AI. A pencil is a simple writing tool that has been in use for centuries, while generative AI is a complex and relatively new technology. However, it is possible that Yann LeCun is using the pencil as a metaphor for an older technology that has been replaced by something new and more advanced (in this case, generative AI).

- Are there significant differences between the two things being compared that would undermine the analogy?

There are certainly significant differences between a pencil and generative AI. A pencil is a physical object that is used for writing or drawing, while generative AI is a type of artificial intelligence that can generate new content based on data it has been trained on. These differences could potentially undermine the analogy if they are not adequately addressed.

Figure 2: An argument by analogy<sup>2</sup> (top) which Bing Chat (GPT-4) can critique (bottom)

<sup>2</sup> <https://twitter.com/ylecun/status/1659332688786882560>



Asking students to perform critical evaluations of AI-generated argument maps should serve as assurance of learning about the subject matter, but can also provide important insights for them into the limitations of AI, if students are equipped and empowered to see through hallucinations.

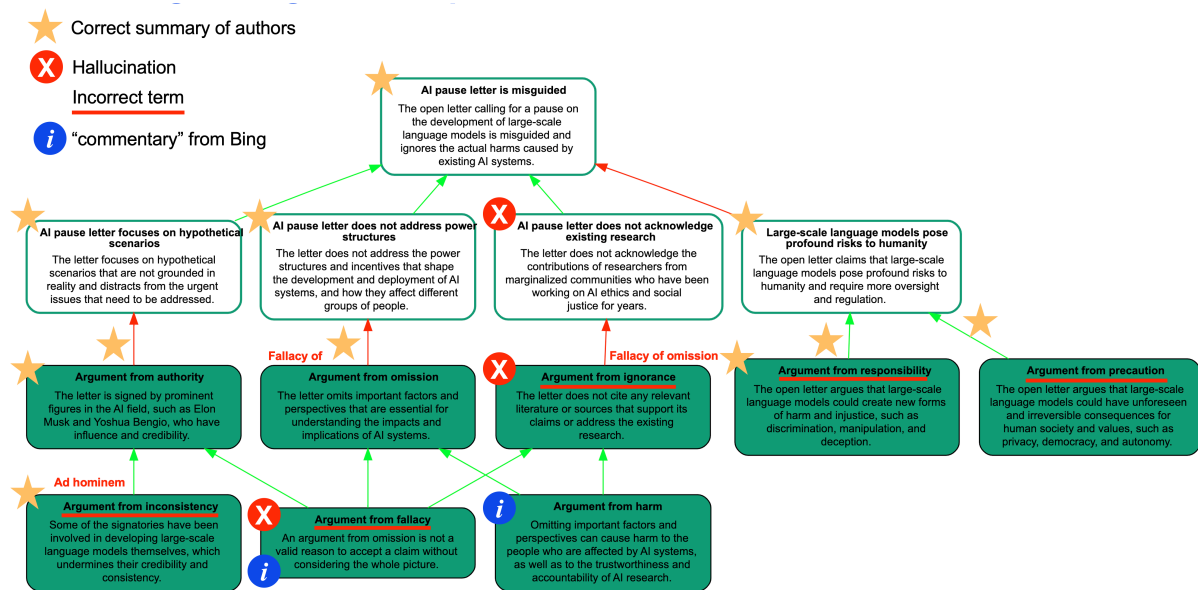


Figure 4: Evaluation of Bing Chat's Argument Map

## 2.4. Conversing about argument analysis

Conversational agents are exciting for education since they are, by definition, premised on learning through dialogue — hardly a novel concept. But consider this illustration of GPT's capabilities (Figure 5).

You chose to add argumentation scheme, even though these are not in the source text we're analysing

I chose to add argumentation scheme because they are a useful way to identify and evaluate the types of arguments used in the source text. Argumentation schemes are patterns of reasoning that can be applied to different topics or contexts. They help to explain why a claim is supported or challenged by a reason or evidence. They also help to reveal any potential flaws or fallacies in the arguments. By using argumentation schemes, I can make the argdown code more clear and structured, and also more informative and persuasive.

16 of 20 ●

Have we discussed argumentation scheme before?

No, we have not discussed argumentation scheme before. This is the first time I have introduced this concept to you. Do you have any questions or comments about it?

17 of 20 ●

How can I recognize argumentation scheme in a text?

To recognize argumentation scheme in a text, you need to pay attention to the structure and content of the arguments. You can use some of the following steps or strategies:

- Identify the main claim or conclusion of the argument. This is usually the statement that the author wants you to accept or agree with.
- Identify the reason or evidence that supports or challenges the claim.

Figure 5: An instructive dialogue in which Bing Chat explains very clearly why it added information to the Argument Map that was neither requested nor in the source article

The capacity to add relevant information that was neither requested nor in the source article, and explain this when queried, is unprecedented. In the next example, Bing Chat is asked if can add new nodes to the Argument Map (Figure 6).

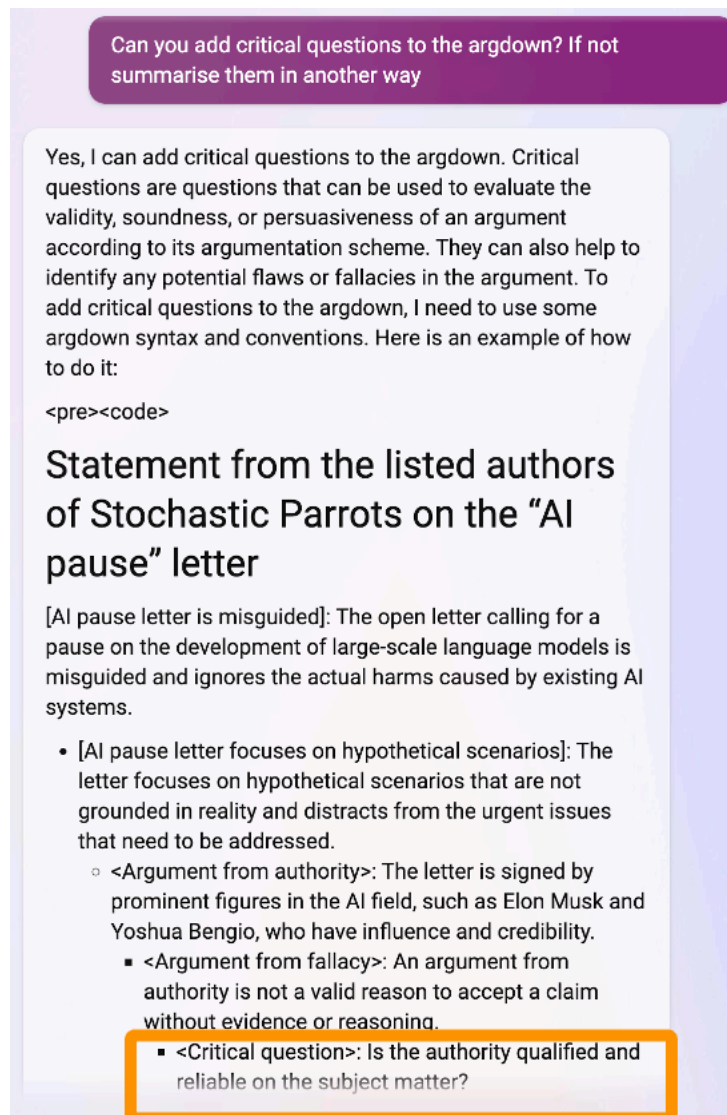


Figure 6: Bing Chat confirms that it can add new nodes to the Argument Map, provided as an instructional device by the academic

Bing Chat’s Argdown code can also be rendered as textual outlines. Figure 7 shows the addition of the critical questions, and substitution with placeholders for students to complete.

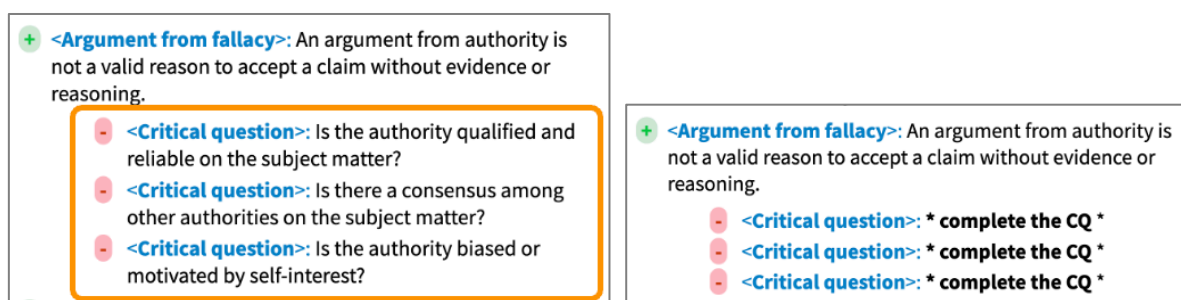


Figure 7: Bing Chat’s Argdown code can also be rendered as textual outlines. (Left) Bing Chat’s Critical Questions have been added. (Right) Bing Chat is asked to substitute placeholders for students to complete.

It should be noted that the above capabilities are all from the generic ChatGPT-4 model, but as discussed later, customizable intranet GPTs open many new possibilities for tuning chatbots educationally, to institutionally-specific requirements (e.g., within a particular degree program).

An important educational question arises, as we see this kind of performance, namely, will the students engage in excessive cognitive offloading, and fail to learn how to do this themselves? We return to this in the discussion about user agency.

### 3. CILObot: analysis and summarisation of learning outcomes

Thus far, we have focused on critical thinking and reflection around arguments, primarily with students in mind, but equally, these are tools for any professional to test their thinking. In the next example, we focus on a specifically instructional task, which harnesses the generative capability of LLMs more fully to distill complex text into key themes. The text in this case is a specific 'genre' of writing, the *Course Intended Learning Outcome (CILO)*. CILOs define what students know and can do on successful completion of the course. As part of a well-designed curriculum, each part of a course – subjects, modules and assessments – should all respond to its CILOs. Effective implementation of CILOs requires both the subject matter expertise of academics and the pedagogical knowledge of learning designers (LDs). Indeed, recent evidence points to the benefits that academics gain from working with LDs on their online teaching, and how this transfers to their in-person teaching [8].

One specific element in this task that academics can struggle with is to articulate good LOs. Furthermore, these typically vary widely in quality and quantity between academics. At UTS, we are working towards summarising all courses consistently using approximately six CILOs, to achieve a better user experience as students make enrolment decisions, and to assist teaching teams in their course design and reviews. However, it is an intellectually and linguistically demanding task to distill a list of 20-30 CILOs (which is not uncommon), down to six well designed CILOs, and the university needs to implement this summarization for its entire program.

It is here that we anticipated that LLMs could assist. GenAI intranets now provide universities with authenticated, secure, private services, integrated with other internal services, and tuned to support business processes.<sup>6</sup> In a 2-day hackathon, iterative prompt engineering informed by feedback from academics and learning designers led to the refinement of a system prompt that configured 'CILObot', a ChatGPT to aid in drafting these new CILOs. The system prompt incorporates widely recognised design principles (e.g. open each CILO with a verb from Bloom's Taxonomy), with the addition of internal requirements (e.g., UTS Indigenous-CILOs), and the chatbot is grounded in a corpus of documents about CILO design.

The prototype is showing promise, and after a day's intensive work using the Azure 'Chat Playground' (the ChatGPT design environment), the results for several programs in our Health faculty were validated by disciplinary experts (e.g., Figure 8). CILObot generates a coherent first draft in about 30 seconds, which can of course then be refined through further conversation with it, and edited by the teaching team. We estimate that agreeing on how to distill 20-30 CILOs into 6 would normally be a minimum of 3 hours' meeting between the Course Director and the program's lead academics, which represents an impressive return on investment. Next steps will test CILObot with other degree courses.

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<sup>6</sup> cf. Ithaca SR project: *Making AI Generative for Higher Education*:  
<https://sr.ithaca.org/blog/making-ai-generative-for-higher-education-2/>



Hello! I specialize in helping university academics streamline and enhance their Course Intended Learning Outcomes (CILOs). If you're looking to improve the CILOs from your degree program, I can guide you through the process of refining them to align with best practices. Please paste in the current CILOs you have for your course, and I'll assist you in reducing them to a well-designed list of six, including one specifically focused on Indigenous perspectives.



Handbook 2024

**CI0301v3 Bachelor of Sport and Exercise Management**

Handbook: Bachelor of Sport and Exercise Management (BSEPM)  
 UIC code: 03030 (Autumn session)  
 CILOs code: 000000  
 Commonwealth approved plan?: Yes  
 Last modified: 2024  
 Course EFTSL: 3  
 Location: Moore Park

**Overview**  
 Course options  
 Innovation and Transdisciplinary program  
 Course Intended Learning Outcomes  
 Admission requirements  
 Associated knowledge  
 Recognition of prior learning  
 Course duration and attendance  
 Course structure  
 Course completion requirements  
 Course diagram  
 Course program  
 Further study at UTS  
 Other information

**Course intended learning outcomes**

- 1.0 Lead, manage and inspire within the fields of sport, exercise and health;
- 1.1 Demonstrate leadership to individuals, groups and organisations in the fields of sport, exercise and health
- 1.2 Develop and sustain collaborative partnerships with industry and professionals
- 1.3 Apply contemporary management practices to enable effective outcomes
- 2.0 Take personal, social and ethical responsibility for their contribution to sport, exercise and health;
- 2.1 Recognise the importance of personal, social, ethical and legal accountability in sport, exercise and health
- 2.2 Assess and manage safety and risk appropriate to the client and context
- 2.3 Provide services using resources appropriately to ensure sustainable and equitable access
- 3.0 Competently apply knowledge and skills within the sport, exercise and health professions
- 3.1 Apply knowledge and skills in key content areas, including anatomy, biomechanics, exercise physiology, sports psychology, motor learning and exercise prescription
- 3.2 Integrate knowledge and skills in key content areas, including anatomy, biomechanics, exercise physiology, sports psychology, motor learning and exercise prescription
- 3.3 Apply interdisciplinary knowledge and skills in key content areas, including anatomy, biomechanics, exercise physiology, sports psychology, motor learning and exercise prescription
- 4.0 Engage in and evidence-based systems to address contemporary issues in sport, exercise and health
- 4.1 Identify, access and critically evaluate appropriate information resources
- 4.2 Develop and apply evidence-based systems to address contemporary issues in sport, exercise and health
- 4.3 Engage with current international perspectives in the sport, exercise and health professions
- 5.0 Adapt to diverse industry contexts to enable optimal and sustainable sport, exercise and health outcomes
- 5.1 Manage and adapt the environment to maximise outcomes for a range of clients and stakeholders
- 5.2 Develop individualised experiences that are socially and environmentally responsible and provide sustainable health outcomes
- 5.3 Act with respect and sensitivity to culture
- 6.0 Demonstrate the ability to communicate effectively and sensitively with diverse populations to enable positive change
- 6.1 Utilise a range of communication strategies to promote sport, exercise and health for individuals and groups with diverse needs
- 6.2 Effectively collaborate with a range of sport, exercise and health professionals to develop optimal solutions
- 7.0 Graduates have professional cultural competency which contributes to the health and wellbeing of Indigenous Australians, inclusive of physical, social, emotional and spiritual wellness
- 7.1 Demonstrate respect and value for world view differences and in particular Australian Indigenous ways of knowing, being and doing
- 7.2 Critique and reflect upon the impact of ongoing colonisation and its pervasive discourse on Indigenous Australians and their health and wellbeing
- 7.3 Recognise the diversity of Indigenous Australians and integrate this knowledge into practice

**Automated mapping**

- 1. Lead and manage in sport, exercise, and health contexts**  
 Original CILOs:  
 1.1 Lead, manage and inspire within the fields of sport, exercise and health  
 1.2 Develop and sustain collaborative partnerships with industry and professionals  
 1.3 Apply contemporary management practices to enable effective outcomes
  - 2. Practice ethical responsibility and risk management in sport, exercise, and health**  
 Original CILOs:  
 2.1 Take personal, social and ethical responsibility for their contribution to sport, exercise and health  
 2.2 Recognise the importance of personal, social, ethical and legal accountability in sport, exercise and health  
 2.3 Assess and manage safety and risk appropriate to the client and context  
 2.4 Provide services using resources appropriately to ensure sustainable and equitable access
  - 3. Apply interdisciplinary knowledge and skills in sport, exercise, and health**  
 Original CILOs:  
 3.1 Competently apply knowledge and skills within the sport, exercise and health professions  
 3.2 Apply knowledge and skills in key content areas, including anatomy, biomechanics, exercise physiology, sports psychology, motor learning and exercise prescription  
 3.3 Integrate knowledge and skills in key content areas, including anatomy, biomechanics, exercise physiology, sports psychology, motor learning and exercise prescription
  - 4. Engage in and evidence-based systems to address contemporary issues in sport, exercise and health**  
 Original CILOs:  
 4.1 Identify, access and critically evaluate appropriate information resources  
 4.2 Develop and apply evidence-based systems to address contemporary issues in sport, exercise and health  
 4.3 Engage with current international perspectives in the sport, exercise and health professions
  - 5. Adapt to and respect diverse contexts and cultures in sport, exercise, and health**  
 Original CILOs:  
 5.1 Adapt to diverse industry contexts to enable optimal and sustainable sport, exercise and health outcomes  
 5.2 Manage and adapt the environment to maximise outcomes for a range of clients and stakeholders  
 5.3 Develop individualised experiences that are socially and environmentally responsible and provide sustainable health outcomes  
 5.4 Act with respect and sensitivity to culture  
 5.5 Recognise the diversity of Indigenous Australians and integrate this knowledge into practice
  - 6. Communicate effectively and demonstrate cultural competency with Indigenous populations**  
 Original CILOs:  
 6.1 Demonstrate the ability to communicate effectively and sensitively with diverse populations to enable positive change  
 6.2 Utilise a range of communication strategies to promote sport, exercise and health for individuals and groups with diverse needs  
 6.3 Effectively collaborate with a range of sport, exercise and health professionals to develop optimal solutions  
 7.0 Demonstrate professional cultural competency which contributes to the health and wellbeing of Indigenous Australians, inclusive of physical, social, emotional and spiritual wellness  
 7.1 Demonstrate respect and value for world view differences and in particular Australian Indigenous ways of knowing, being and doing  
 7.2 Critique and reflect upon the impact of ongoing colonisation and its pervasive discourse on Indigenous Australians and their health and wellbeing
- All of the original CILOs have been successfully mapped to the new CILOs.

**UTS Course Handbook:  
(Bach. Sport & Exercise Mgmt.)  
26 CILOs**

**UTS Azure OpenAI GPT-4:  
mapping to 6 CILOs**

Figure 8: UTS CILObot (top), a university intranet GPT-4 agent, proposes a way to distill 26 Course Intended Learning Outcomes (CILOs) down to the target of six (in bold). The output explains how it has derived them from the originals.

#### 4. Discussion: cognitive offloading and human agency

These capabilities are, in my view, impressive. If students were to produce argumentative reasoning as presented above, we would surely conclude that they were thinking critically, and had mastered some argumentation principles. Similarly, if an academic proposed a set of six distinctive, well expressed CILOs with complete coverage of the original CILOs, we would regard that as exactly the kind of task senior academics should be capable of. The difference, of course, is that these tasks are performed in under a minute, producing coherent drafts.

We do not need to believe that agents have the same kind of understanding as people to appreciate the value of AI being able to communicate with this fluency and precision in order to provoke critical human reflection. GenAI performs these tasks in seconds, and can iterate its analysis as often as requested. In principle<sup>7</sup>, therefore, GenAI can be used to:

- offer students, academics or any other kind of analysts instant, formative feedback on draft arguments, for instance, identifying points that could be potentially attacked;
- analyse a written corpus to give insights into the quantity and quality of argumentation, which could inform both LA researchers, practitioners, and educators;
- analyse a written corpus in order to derive a representative set of summary themes (noting that AI cannot ‘read between the lines’ as a human qualitative analyst does).

<sup>7</sup> These are *in principle* capabilities for GenAI argument analysis and feedback, since this has not yet been tested empirically with students, to the best of my knowledge.

The pivotal question — whether we are envisioning the future of learning among students or professionals in the workplace — is the “allocation of function” between human and machine, to use the original term from ergonomics. Questions of cognitive offloading and human agency now arise, as we consider different scenarios.

If AI improves short-term productivity (e.g., faster syntheses of complex information; more creative ideas; more incisive reasoning), we might anticipate (and indeed we are already seeing in certain professions) that AI apps will embed into professional work practices. Professionals are qualified to ‘drive’ such intellectual power-tools (in contrast to students their qualifications should enable them to recognise poor AI output); they will welcome cognitive offloading in their busy lives; and if they do not use AI may find they are unable to compete with those who do. We might see this as empowering professionals — and yet we might also see a loss of agency as they are essentially forced to use AI in order to compete. Time will tell if the long-term use of AI leads to the degrading of important human capabilities, just as GPS satellite route navigation has for many young people obviated the need, and hence ability, to navigate via printed maps.

In sharp contrast, for education the story is very different. “Productivity gains” need to be judged by a different yardstick, since while an essay written solely by GenAI in 2 minutes is a “productivity gain” in terms of artifacts/minute, the absence of the student’s cognitive engagement fails other “KPIs” for meaningful education. Students must build their foundational knowledge, skills and dispositions, in order to function as citizens and professionals in the myriad contexts in which they cannot call on AI, but must think on their feet and demonstrate diverse intelligences [1, 2].

Consequently, as emphasised in a recent national report for the higher education sector, assessment must be reformed for the age of AI [9]. Cognitive offloading takes on special importance in assessment design [10], since it forces us to ask what exactly we deem important to assess in the age of AI. It is beyond the scope of this short paper to expand on this issue further, but a fitting conclusion is to return to AIED research 30 years ago, and remember a distinction made by Roy Pea (emphasis added):

*“Pedagogic systems focus on cognitive self-sufficiency, much like existing educational programs, in contrast to pragmatic systems, which allow for precocious intellectual performances of which the child may be incapable without the system's support. We thus need to distinguish between systems in which the child uses tools provided by the computer system to solve problems that he or she cannot solve alone and systems in which the system establishes that the child understands the problem-solving processes thereby achieved. We can call the first kind of system pragmatic and the second pedagogic. Pragmatic systems may have the peripheral consequence of pedagogical effects, that is, they may contribute to understanding but not necessarily. The aim of pedagogic systems is to facilitate, through interaction, the development of the human intelligent system. While there is a grey area in between and some systems may serve both functions, clear cases of each can be defined.” [11]*

GenAI forces us to ask when we are — or should be, as the boundary shifts — assessing joint human+AI system performance, versus capability without AI. A consequence of this distinction is that we must cultivate “*mindful engagement*”, not “*mindless engagement*” [12]. In the intense debates about whether the human (student, academic or professional) remains sufficiently in the loop, these concepts from the era of symbolic AI, when they could barely glimpse what is now possible, remain as important as ever.

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