Expert Panel OCCE 2024: Opportunities and challenges for AI in Education: One year after ChatGPT

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Abstract

In this paper we examine the opportunities and challenges presented by artificial intelligence (AI) in education, one year after the release of ChatGPT. Drawing from an expert panel discussion at OCCE 2024, we address the multifaceted nature of AI and its potential to transform education. We emphasise the importance of developing AI literacy among educators and students, extending beyond technical knowledge to encompass ethical considerations and societal impacts. We highlight the need for precision when discussing AI, distinguishing between various types and their specific uses in education, such as adaptive learning systems and data analytics. We warn against conflating generative AI (GenAI) with AI as a whole, noting that GenAI represents only a fraction of AI's potential applications in education.
Key challenges discussed include the explainability of AI systems, particularly GenAI, and the need for transparent, accountable use in educational settings. We recommend using AI as secondary support tools rather than primary decision-makers, especially in high-stakes assessments. We advocate for a two-pronged approach: educating about AI while empowering its ethical and effective use. We underscore the necessity of a strong informatics curriculum as a foundation for understanding AI while also integrating AI topics across curricula. We highlight the potential of AI to exacerbate or alleviate educational inequalities and call for vigilance in its implementation. For educators, we suggest using GenAI for lesson planning as a low-risk starting point, while emphasizing that the depth of AI knowledge required may vary based on individual contexts and needs.

Introduction

This expert group was convened for OCCE 2024 to provide a panel discussion with audience participation focused on opportunities and challenges for AI in education. The reference to ChatGPT was designed to indicate consideration of the changing landscape in education with a broad focus on types of AI but with awareness of how Generative AI (GenAI) such as ChatGPT has changed people's perspectives and the timescale for change.

The panel was constituted to include representatives from both school education and university education and with a mixture of people with strong computer science backgrounds and those whose main focus is education. All members of this expert panel agreed in advance that the following questions are good starting points.

1. What do teachers and students need to understand about machine learning and AI in order to evaluate its potential?

2. Which are likely to be the most important areas of education for AI to make a difference? – management, learning, assessment?

3. What are currently the most promising areas of AI application for learning that schools can make immediate use of?

4. Where should a teacher or school start in establishing its approach to developing the use of AI?

5. What safeguards do schools need to put in place to ensure that AI does not harm students or teachers?

6. Are safeguards needed for generative AI different from those needed for AI more generally? I.e. does generative AI pose a specific set of risks?

This article summarises the main points on which we, the panel, agreed and identifies issues that we considered to be particularly crucial from those that arose during discussion and from audience questions.

The changing landscape of education and AI

The public release of ChatGPT in November 2022 brought widespread attention to the rapidly advancing capabilities and vast potential of generative AI. While GenAI, as one type of AI application, can create and edit a range of different media quickly, supporting learners, teachers and managers in education, a range of other AI functionalities are also useful to education (see Holmes and Tuomi 2022 for an overview). AI functionalities that may be particularly useful for learners include: conversational AI, predictive AI, speech recognition, robotics, computer vision, learning and assessment analytics and personalised feedback (Webb, Fluck et al. 2021). However, disparities remain in terms of how these functionalities work for specific learners (Akgun and Greenhow 2022). Nevertheless, these functionalities can be combined to create a wide range of opportunities. Therefore AI functionalities are being embedded in most systems and applications (Gill, Xu et al. 2022). At the same time AI is creating significant challenges for education as well as society more widely (Rawas 2024). The multi-dimensionality of AI and the wide-ranging nature of opportunities and challenges has led to calls for regulation and the establishment of new norms (see Rawas 2024 for an overview). However, as Baronchelli (2024) argues, the very rapid developments in AI mean that the usual mechanisms for establishing norms cannot keep pace. At the same time many organisations,

including educational establishments, have had to introduce regulations in order to continue their practices particularly in relation to assessment.

The wide availability of GenAI challenges all teachers to consider how they can increase their own productivity through its use as well as provide their students with new learning opportunities. However GenAI comes with warnings regarding inaccuracies, “hallucinations”, bias, et cetera. More fundamentally perhaps, interacting with a large language model, could be a disconcerting or potentially damaging experience if the person does not realise the nature of that technology and just responds to its human-like characteristics. At the same time the rapid developments in AI together with the need for regulations can result in policies that are not fit for purpose (Roshanaei, Olivares et al. 2023). Organisations therefore need to continue to follow developments in AI and to keep their policies under review. Likewise, teachers and educational leaders need to think about how they can mitigate these problems and limitations, how they should educate themselves and their students to understand and make best use of such tools in their learning as well as how they can contribute to decisions and developments in the use of AI and society. To effectively address these challenges, it is vital to understand what AI actually is. Without a clear understanding and a common language to discuss it, educators may find themselves ill-equipped to make appropriate decisions regarding its use in educational settings.

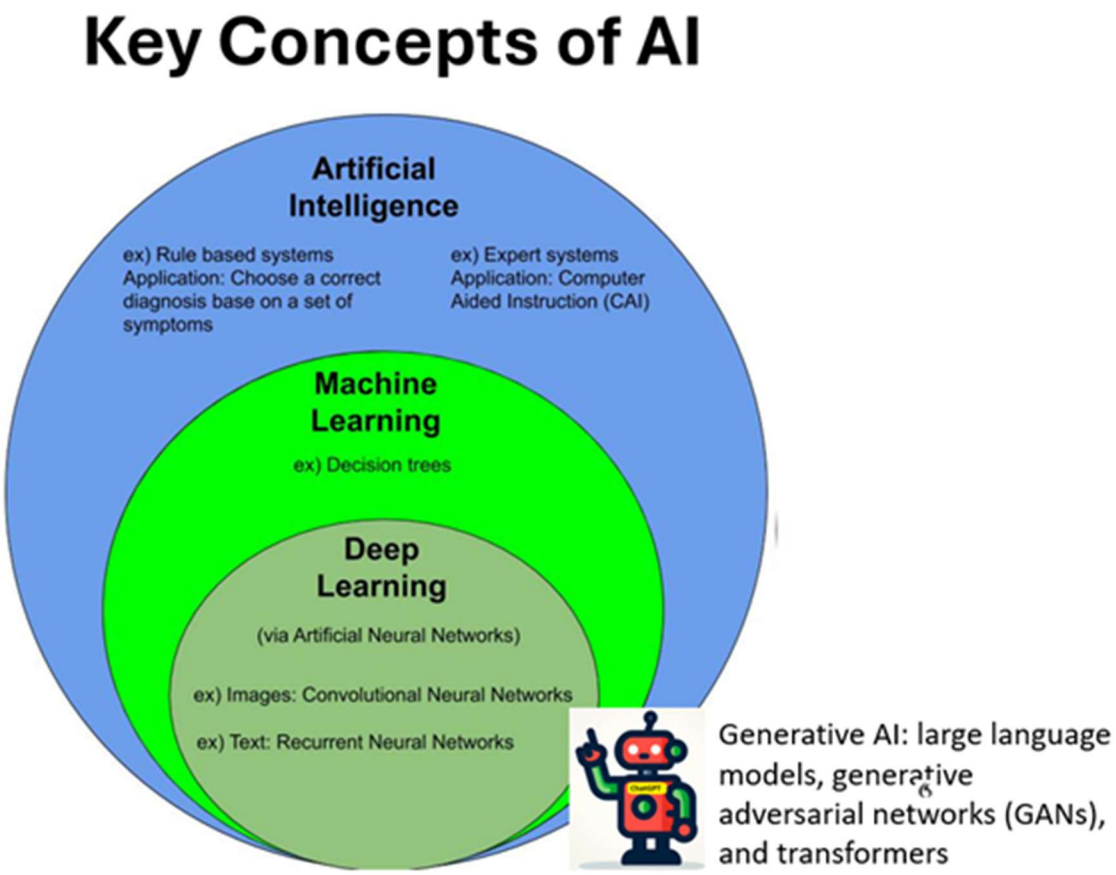
What is AI, and why do educators need to understand it?

AI has been a field of research and practice for over six decades, with its roots tracing back to the 1950s (McCarthy, Minsky et al. 2006). However, it's only recently, with the advent of generative AI, that educators have faced an urgent need to understand its implications. In the span of a single year, we've witnessed prolific use of AI by students across subjects and institutions. Concurrently, we saw the first AI Safety Summit, accompanied by projections of AI reshaping industries and society at large. These rapid developments in AI have profound implications for our education systems. Educators now play a crucial role in preparing students for a future where understanding AI is essential (Touretzky, Gardner-McCune et al. 2019). This "AI literacy" involves not just technical knowledge, but also an understanding of AI's applications and societal impacts. The focus on AI education extends beyond traditional schooling. Many countries are significantly increasing doctoral education and implementing upskilling or reskilling initiatives for adults (Rigley, Bentley et al. 2024). While it may seem that AI primarily concerns computing educators, its impact actually spans all subject areas. Given this widespread influence, we argue that educators from all disciplines must engage with AI concepts, applications, and implications. However, the specific knowledge educators need about AI remains somewhat unclear.

Defining AI is challenging because the technology has been undergoing paradigm shifts (Radanliev 2024) and there are many different definitions and attempts to

clarify for particular purposes (Gil de Zúñiga, Goyanes et al. 2024). Figure 1 (adapted from Webb, Fluck et al. 2021) provides an overview of the key concepts of AI. Having an overview and understanding of these concepts and their interrelationships is important for teachers and learners to make sense of AI functionalities and capabilities and to ensure that people don't equate AI as a whole with GenAI. The diagram In Figure 1 illustrates that AI is a broad idea incorporating a range of technologies with different advantages and limitations. Many, but not all, recent AI applications incorporate machine learning and particularly deep learning with artificial neural networks (ANNs). ANNs have been around for at least 30 years but have only more recently been widely used because they need massive processing power which is now available. Deep learning with ANNs is required for many complex applications such as speech recognition, visual recognition and large language models.

Figure 1 overview of the key concepts of AI and their inter relationships



Thus making sense of AI is a complex and multifaceted process. Furthermore, the EU AI Act (https://eur-lex.europa.eu/eli/reg/2024/1689/oj), which came into force on 1st August 2024, classifies the use of AI systems in education as high-risk and consequently subject to quality, transparency, human oversight and safety obligations, before deployment. A key consideration for all educators, regardless of

what AI tools they are using, is that the EU AI Act's provisions on AI literacy sets out that educational institutions (as "deployers" of AI systems) are responsible for ensuring that their students (as "users") are informed and educated in the use of the AI tools that the institution is using. Consequently, it is imperative that teachers and students have developed the necessary competences to engage with the use of AI applications and systems.

To this end, UNESCO released the first global competency frameworks for teachers (United Nations Educational and Organization 2024) and students (United Nations Educational and Organization 2024) Figure 2 shows an overview of the AI competency framework for teachers (United Nations Educational and Organization 2024 Page 22).

Both frameworks are guided by human rights principles and the need to protect human dignity and privacy and strengthen human agency. These frameworks articulate and define the knowledge, skills and attitudes teachers and students need to understand and actively engage with AI safely, ethically and effectively in education and beyond. However, they take a particularly AI-centric approach to supporting teacher competency, despite the human-centred AI focus. For instance, a crucial question for a teacher should be, "how can I best prepare my students for their future, according to their needs and aspirations." There is limited guidance regarding the more holistic view of education, how the educator should integrate professional learning or expression of these competencies into their existing educational contexts. Indeed, most educators, we fear, would find difficulty having the time for this.

Figure 2 The UNESCO AI competency framework high-level structure: aspects and progression levels

Aspects	Progression		
	Acquire	Deepen	Create
1. Human-centred mindset	Human agency	Human accountability	Social responsibility
2. Ethics of AI	Ethical principles	Safe and responsible use	Co-creating ethical rules
3. AI foundations and applications	Basic AI techniques and applications	Application skills	Creating with AI
4. AI pedagogy	AI-assisted teaching	AI–pedagogy integration	AI-enhanced pedagogical transformation
5. AI for professional development	AI enabling lifelong professional learning	AI to enhance organizational learning	AI to support professional transformation

In contrast, in their research examining skills within the context of healthcare and emergency response scenarios, Bentley et al. (2024), found that there is a risk of emphasising individual competencies in many AI skills frameworks. They argued that

what is needed is to start first by envisioning the transformation sought within a system, and to consider how humans and AI can work together across a matrix of interrelated types of skills and levels of engagement (Bentley, Rigley et al. 2024) (see Figure 3). In this case, it is not only individuals that are implicated, but teams, communities, organisations and AI working together. Moreover, fundamentally, it does not assume that AI will or must be used, but that it is a choice by actors made based on the way these elements come together in a time and place. If technological advancements outpace the discussions and actions surrounding AI governance or the professional and strategic frameworks guiding it, we may find ourselves overwhelmed by a wave of innovation, feeling as though we had no control or choice in its arrival.

Figure 3 From Individual Skills to the Human-AI Synergy Matrix

Transformation	Technological innovation, improvements in methods	Responsible innovation practice	Setting a vision for change
Governance	What should be procured, developed, used	Equitable distribution of roles, responsibilities and support	Conscious (re)distribution of the benefits of AI
Synergy	Designing tasks, workflows to augment capabilities	Developing collaborative human-AI operational environments	Ensuring Human-AI collaboration is doing what it should do
Communication	Interpretability, explainability, networks	Translating between the social and the technical	Safety, security, equity
Awareness	What	How	Why
	Technical	Professional	Strategic

Our educational systems, from primary schools to universities, remain focused on individual learners. As such, these frameworks offer valuable insights for educators. These approaches emphasise that to make informed decisions, teachers must understand AI's nature, its educational applications, and its broader implications. They should also critically evaluate the benefits and drawbacks of AI adoption. Bentley et al.'s matrix goes further, suggesting that this awareness and any resulting changes should be tailored to the specific context. This includes considering the specific needs of students, educators, subject areas, and institutions, as well as their overall goals for transformation.

AI in the curriculum for students

In the preceding section we identified the multidimensionality of AI, the ubiquitous nature of its influence on society, including education, and the necessity for education systems to set their own visions for change. Therefore, while AI can be used to support learning in many curriculum areas, learning about AI is a cross

curricular challenge. In addition, understanding the nature of AI, including necessary technical aspects, requires integrating AI into the Informatics curriculum because understanding basic elements of Informatics supports the development of understanding of AI (Caspersen, Diethelm et al. 2022)**.** Thus in the Informatics reference framework for schools in Europe (ibid.) AI is seen as a theme that runs across all of the core topics in Informatics. However, updating the Informatics curriculum in response to developments in AI is not without controversy. For example, a view stated by the high-profile Nvidia CEO Jensen Huang that programming languages may become obsolete as AI and low-code/no-code tools make it possible for anyone to create software using plain language prompts has led to some debate about the future of programming in schools. {https://thenextweb.com/news/developers-learn-programming-languages-age-of-ai} However, the consensus of this expert panel and among computer science educators (Denny, Prather et al. 2024) https://www.teachai.org/cs is that programmers and AI need to work in collaboration. Thus for young people developing understanding and skills in programming will remain important for understanding computing and AI as well as for developing problem-solving capabilities in STEM subjects and beyond. There is expected however to be increasing focus on data and data driven programming approaches (Grover 2024).

While there has been a global push to enhance informatics education, progress varies significantly across countries. Consequently, students entering higher education often possess limited knowledge of informatics, which can hinder their developing understanding of AI. This variability presents a challenge for teachers and institutions at all educational levels in fostering AI literacy.

Developing robust informatics curricula that incorporate AI is a crucial foundational step. However, addressing AI across different subjects must extend beyond technical aspects. It's essential to explore its social implications, ethical concerns, and the level of trust that can be placed in AI systems. In this context, explainability becomes paramount. Transparent AI systems enable educators and learners to understand how decisions and recommendations are made. This transparency fosters trust and ensures that ethical concerns and potential biases are openly addressed. By emphasizing explainability, we can create a more comprehensive and responsible approach to AI education.

Explainability and the blackbox: a major challenge for education

The deep neural networks (DNNs) being used for many artificial intelligence applications including GenAI depend on complex multilayered networks that are “black boxes” even to their developers. In an international meeting of educators in 2019 which focused on opportunities and challenges with machine learning, explainability was identified as a major issue for the use of AI in education and the solution was to recommend that only explainable AI systems be used in education (Webb, Fluck et al. 2021). We still support this recommendation for systems

involving high stakes judgments, for example summative assessments, where being able to explain the basis of the judgement is essential for trust and accountability. However it is unrealistic and probably counter-productive to insist that all AI systems used in education have built-in explainability at the level of supplying a full trace of their decisions. The architecture of LLMs makes their outputs inherently unexplainable and there are many reasons why building on that architecture to provide explanations of their decisions is difficult or even impossible (see Schneider 2024 for a review). Particularly important reasons for these challenges for explainability include: 1) additional models are now often built onto the foundation LLM to provide for specific content or multimodality and these may come from third-party developers; 2) outcomes result from not just the AI but also from the interactions with the user and 3) there is no access to the underlying models of commercial LLMs leading to a lack of transparency about their architecture and data. Thus developments in GenAI have significantly increased the challenge for explainability. Considering the severe limitations in AI explainability (see Rachha and Seyam 2023 for further detail) we concur with Rachha and Seyam's assertion that AI systems in education should serve as secondary support tools rather than primary decision-makers. Nevertheless, the potential applications of GenAI for support and formative purposes are diverse and numerous. Addressing accountability in light of GenAI's limited explainability requires a multifaceted approach focusing on socio-technical solutions (see Al-kfairy, Mustafa et al. 2024 for a systematic review). Clear policies and guidelines are needed for AI use in educational settings, coupled with comprehensive training programmes on responsible AI use for both teachers and students. The aim is to create an environment where all stakeholders collaborate to ensure that AI technologies enhance learning experiences while upholding academic integrity, transparency, and ethical responsibility. Moreover, it is crucial to view students as active participants in the accountability process, empowering them to engage critically with AI technologies. Findings from Al-kfairy, Mustafa et al.'s review (2024) also emphasised: the importance of collaboration between educational institutions and AI developers to create AI tools tailored to pedagogical needs while maintaining transparency and alignment with academic integrity standards; the integration of ethical considerations into curriculum design to foster critical thinking about AI's societal impact and regular evaluations and audits of AI systems used in education to ensure ongoing accountability and alignment with ethical standards.

Ethical issues for the use of AI in education

The rapid advancements in AI systems, including the explainability challenges discussed earlier, have prompted numerous organizations to develop principles and guidelines. While these frameworks share many commonalities, they are expected to evolve continuously (Nguyen, Ngo et al. 2023). The European Commission's guidelines (European-Commission, Directorate-General for Education et al. 2022) outline requirements for "trustworthy AI" (Figure 4), providing a foundation for evaluating AI systems and outputs. This evaluation is based on educators'

understanding of the system's architecture and capabilities, their subject matter expertise, and output verification.

We advocate for maintaining this "human in the loop" process, even as GenAI systems potentially become more explainable. This is crucial because, given the underlying architecture of LLMs, it's unlikely that GenAI will ever achieve 100% reliability. Simultaneously, research into improving GenAI transparency and explainability should continue, and the implementation of guidelines in various contexts is likely to evolve further.

Figure 4 Key Requirements for Trustworthy AI

Human agency and oversight including fundamental rights, children's rights, human agency, and human oversight.

Transparency including traceability, explainability and communication.

Diversity, non-discrimination, and fairness including accessibility, universal design, the avoidance of unfair bias, and stakeholder participation, which allows use regardless of age, gender, abilities, or characteristics - with a particular focus for students with special needs.

Societal and environmental wellbeing including sustainability and environmental friendliness, social impact, society, and democracy.

Privacy and data governance including respect for privacy, quality and integrity of data, and access to data.

Managing the future for ethical and sustainable use of AI in education

Developments in generative AI (GenAI) are currently progressing at a rapid pace, predominantly driven by large tech companies with access to massive processing power and extensive datasets. This domination, coupled with the lack of transparency in their models, presents significant ethical risks for education, as previously discussed.

However, the landscape of LLMs is in flux. A growing number of open-source and specialised LLMs are emerging, typically offering much greater transparency regarding their models and data compared to those produced by large tech companies (https://opencv.org/blog/open-source-llms/). We advocate monitoring these developments as they may provide more ethical alternatives for educational use. Additionally, open-source models developed by the broader community of developers may be more successful in addressing the excessive energy consumption associated with GenAI (Budennyy, Lazarev et al. 2022, Crawford 2024), a critical consideration for sustainable use in education.

Experienced teachers are increasingly harnessing GenAI to create lesson plans and resources. This practice carries low risk for skilled educators who can effectively

evaluate and refine AI-generated content. By utilizing GenAI, these teachers boost productivity while maintaining high-quality educational materials. This blend of human expertise and AI streamlines lesson preparation, freeing up time for personalised student instruction. Furthermore, these practices enable teachers to develop their expertise and understanding of GenAI thus enabling them to consider the potential for wider use of AI will.

The future of AI in education should be guided by educators possessing a well-developed digital competence coupled with robust pedagogical knowledge. These educators must also have a deep understanding of learners' needs and the ability to critically evaluate AI functionalities and applications. This evaluation should be based on their expertise and the evolving guidelines discussed previously. As educators, we all have a responsibility to educate ourselves about:

1. The fundamental nature of AI
2. Current developments in the field
3. Future possibilities and potential impacts

By developing this comprehensive understanding, we can effectively harness AI's potential while mitigating its risks in educational settings

Conclusion

In summary the panel agreed on a number of key and interrelated Issues, challenges and recommendations.

1. AI has the potential to be transformative in education and society at large. However, we must critically examine how AI's benefits are distributed. We are witnessing the early stages of what many describe as a revolution, potentially as significant as the advent of the Internet. This comparison is instructive: like the Internet, AI may both alleviate and create new forms of inequality. While the Internet has democratised access to information in many ways, it has also led to new digital divides in areas such as digital literacy, quality of access, and advanced usage. Similarly, as AI innovation accelerates, we must be vigilant about its potential to exacerbate existing inequalities or create new ones, particularly in educational contexts where equitable access and use are crucial.

2. All educators need to develop a comprehensive understanding of AI, including its potential, associated issues, and limitations. This knowledge is crucial for two reasons: 1) to use AI appropriately in educational settings and 2) to effectively advocate for necessary changes with policy makers and designers. However, this broad statement is akin to saying that all authors need to understand writing. While true in principle, it oversimplifies a complex reality. Just as writing encompasses various forms, styles, and purposes, AI in education is multifaceted. The specific AI knowledge valuable to educators depends on numerous factors, including:

1. Their subject area and teaching level
2. The types of AI tools relevant to their field

3. The technological infrastructure of their institution
4. The evolving landscape of AI in education policy

Therefore, while a foundational understanding of AI is necessary for all educators, the depth and focus of this knowledge may vary significantly based on individual contexts and needs. A good starting point for experienced teachers is to use GenAI for developing their lesson plans and resources. Such practice is low risk provided that teachers understand the limitations of GenAI and have the knowledge and experience to evaluate and refine the material produced by the AI. At the same time such practices can free up teacher time for student support et cetera.

3. When discussing AI, precision is crucial due to its multifaceted nature. AI encompasses a broad spectrum of technologies, methodologies, and applications, each with distinct characteristics and implications. To foster meaningful dialogue and informed decision-making, particularly in educational contexts, we must differentiate between various types of AI and their specific uses.

It is particularly important not to conflate GenAI with AI as a whole. While GenAI's recent advancements are remarkable, they represent only a fraction of AI's potential applications and impacts. In education, for instance, AI encompasses not just content generation tools, but also adaptive learning systems, automated grading, personalized tutoring, and data analytics for educational management. By maintaining this comprehensive and precise understanding of AI's diverse forms and applications, educators, policymakers, and stakeholders can more effectively:

1. Evaluate the appropriate uses of specific AI technologies in educational settings
2. Recognize the limitations of different AI systems
3. Address the ethical considerations associated with each type of AI
4. Make informed decisions about AI integration in curriculum and administration
5. Develop targeted strategies for AI literacy among students and staff

4. Explainability in AI systems is crucial in education for ensuring transparency, addressing ethical concerns, providing pedagogical value, and maintaining accountability. However, with the advent of GenAI, explainability has become significantly more challenging due to the complexity, black-box nature, emergent behaviours, and stochastic processes inherent in these systems. In educational settings, the lack of explainability in GenAI poses several challenges. These include difficulties in validating AI-generated content, building trust among users, and addressing potential misinformation. The opacity of GenAI systems can lead to skepticism about their use in education and raises concerns about the verification of AI-assisted outputs.

To address these challenges, researchers and educators are exploring various approaches. These include developing more interpretable AI models, creating post-hoc explanation methods, implementing AI literacy programs, and establishing ethical guidelines for AI use in education. These efforts aim to make AI systems more transparent and understandable to both educators and students.

However, given the current limitations of these developments, we recommend that AI systems in education should serve as secondary support tools rather than primary decision-

makers. For instance, their use in high-stakes assessments cannot yet be justified due to the ongoing challenges with explainability and potential biases. As AI technology continues to evolve, maintaining a cautious and critical approach to its implementation in educational settings remains essential.

5. Our educational approach to AI must be twofold: we need to educate all young people about AI while simultaneously empowering them to use AI ethically, effectively, and appropriately. This comprehensive education extends beyond technical knowledge and spans multiple curriculum areas, addressing the ethical and societal implications of AI.

To achieve this, we should:

1. Integrate AI-related topics across various subjects, highlighting its interdisciplinary nature
2. Foster critical thinking skills to evaluate AI's impact on society
3. Develop practical skills for ethical AI use in different contexts

Crucially, this educational process must be underpinned by a strong curriculum in Informatics. This foundational knowledge provides the necessary context for understanding AI's technical aspects, enabling students to grasp both its potential and limitations.

By combining broad AI literacy with deep technical understanding, we can prepare young people to navigate and shape an AI-driven future responsibly. Consequently, users must develop the ability to critically evaluate both the nature of AI systems and their outputs to ensure ethical use.

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