RICK ANALYSIS OF GENERATIVE ARTIFICIAL INTELLIGENCE IN EDUCATION AND RESEARCH WITH GUIDELINES FOR RESPONSIBLE USE AND ROLE ATTRIBUTION

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The subject of the research is the analysis of the advantages and risks associated with the adoption of generative artificial intelligence (GAI) in education and research, as well as the development of policies for its ethical and responsible use. The objective is to propose recommendations for the attribution of GAI's role in education and research, based on an analysis of the associated risks. The article addresses the following tasks: analyze the benefits of GAI in facilitating personalized and adaptive learning, automating content creation, and accelerating data synthesis for research; identify and categorize risks associated with the use of GAI in higher education, and suggest strategies for mitigating these risks; propose recommendations for ensuring transparency and accountability in the use of GAI-generated content in education and research. The following methods are used: systematic review of current literature on the application of GAI in education and research, comparative analysis of GAI-related practices in academic institutions, and risk categorization based on the potential ethical and practical implications of GAI usage. The research highlights key advantages of GAI, such as enhancing personalized learning experiences, automating the creation of educational materials, and accelerating research through data synthesis. At the same time, it identifies critical risks, including overreliance on GAI, perpetuation of bias, the phenomenon of GAI "hallucinations," and threats to academic integrity. Based on these findings, the article offers a set of recommendations for developing comprehensive policies that govern the ethical use of GAI in higher education. The proposed policies and recommendations provide a foundational framework for universities to develop tailored GAI governance strategies that reflect the specific needs and practices of their educational and research activities. These policies are designed to promote ethical GAI use, ensure transparency, and mitigate potential risks, while maximizing the benefits of GAI technologies. Furthermore, the study emphasizes the importance of continuous evaluation and adaptation of these policies as GAI technologies evolve.

Key words: *generative artificial intelligence, generative AI, higher education, personalized learning, academic integrity, AI risks, algorithmic bias, hallucination, educational policy, AI governance.*

Краковецький О. Ю., Шевченко Н. Ю. Аналіз ризиків генеративного штучного інтелекту в освіті та дослідженнях з рекомендаціями щодо відповідального використання та зазначення ролі

Об'єктом дослідження є аналіз переваг і ризиків, пов'язаних із впровадженням генеративного штучного інтелекту (ГШІ) в освіті та дослідженнях, а також розробка політик його етичного та відповідального використання. Мета дослідження – розробити рекомендації щодо визначення ролі ГШІ в освіті та дослідженнях на основі аналізу відповідних ризиків. У статті розглядаються наступні завдання: аналіз переваг ГШІ у сприянні персоналізованому та адаптивному навчанню, автоматизації створення контенту та прискоренні синтезу даних для досліджень; визначення та категоризація ризиків, пов'язаних із використанням ГШІ у вищій освіті, та запропонувати стратегії для їх мінімізації; розробити рекомендації для забезпечення прозорості та підзвітності у використанні контенту, створеного ГШІ, у навчальних і дослідницьких процесах.

Методи дослідження включають: системний огляд сучасної літератури щодо застосування ГШІ в освіті та дослідженнях, порівняльний аналіз практик використання ГШІ

в вищих навчальних закладах, категоризація ризиків з урахуванням потенційних етичних і практичних наслідків використання ГШІ. За результатами дослідження виявлено ключові переваги ГШІ, такі як покращення персоналізованого навчального досвіду, автоматизація створення навчальних матеріалів та прискорення досліджень завдяки синтезу даних. Водночас визначено критичні ризики, серед яких надмірна залежність від ГШІ, відтворення упереджень, феномен «галюцинацій» ГШІ та загроза академічній доброчесності. На основі отриманих результатів запропоновано низку рекомендацій для розробки комплексних політик, що регулюють етичне використання ГШІ у вищій освіті. Рекомендації спрямовані на розробку індивідуальних стратегій управління ГШІ для вишів які відповідають їхнім освітнім і дослідницьким потребам. Політики мають забезпечити етичне використання ГШІ, прозорість і мінімізацію потенційних ризиків, одночасно максимізуючи переваги технологій ГШІ. Окрім того, у дослідженні наголошується на важливості постійної оцінки та адаптації цих політик по мірі розвитку технологій ГШІ.

Ключові слова: *генеративний штучний інтелект, ГШІ, вища освіта, персоналізоване навчання, академічна доброчесність, ризики ІІ, алгоритмічні упередження, галюцинації, освітня політика, управління ІІ.*

Problem definition. In the rapidly evolving landscape of educational technology, GAI tools such as ChatGPT by OpenAI, Microsoft Copilot, Gemini by Google, Claude by Anthropic, Perplexity and others are transforming the way educators and researchers approach the process of learning and content creation. These GAI tools offer a bunch of advantages, including brainstorming, outlining, thesis generation, summarization, paraphrasing, grammar and syntax checks, vocabulary enhancement, collaborative writing, feedback and revision, data visualization, multimodal assignments, accessibility support, as well as reasoning and problem solving. The integration of GAI tools into educational practices not only augments the learning experience but also fosters a culture of innovation and inclusivity. The prohibition of generative artificial intelligence can be compared to the historical bans on calculators or computers, which once sparked similar debates about threats to academic and professional skills. Such a prohibition should be regarded as short-sighted and potentially harmful, as technologies like GAI are tools that can significantly enhance the efficiency of educational and research processes. Instead of a total ban, efforts should be focused on developing ethical and practical frameworks for integrating GAI into educational and scientific activities, which will help avoid misuse and promote the development of critical thinking and creative skills.

However, alongside the benefits, using GAI in education highlights the importance of balancing technology to improve learning outcomes with preserving the core values of academic integrity and independent thinking. As GAI continues to evolve, our strategies for integrating these tools into the learning process must also adapt. It's essential that they support learning and creativity rather than replace intellectual effort.

In this context, defining clear GAI usage policies in education and research is crucial. This paper focuses on developing guidelines to ensure GAI tools complement traditional learning while maintaining academic integrity and fostering independent thought. It aims to provide a framework for the ethical and effective integration of GAI.

Analysis of recent studies and publications. The integration of GAI technologies in education and research is a topic of burgeoning interest within the academic community. This field explores the potential benefits and challenges of applying GAI to create personalized learning experiences, generate new content, and enhance research methodologies. The overview of current papers on this subject provides a spectrum of insights into how GAI is shaping the future of education and research, alongside the ethical and practical considerations that accompany its adoption. In the study [1], the author analyzes approaches to preventing plagiarism in scientific publications, maintaining academic integrity in the university environment, and changes in the assessment

of students' academic achievements. The authors formulated a hypothesis regarding the convergence of interests in research ethics and the responsible use of GAI, and provided recommendations for researchers and editorial boards of scientific journals on promoting responsible presentation of research results in the context of the growing accessibility and use of GAI. The article [2] discusses the impact of GAI on higher education, particularly in automating administrative tasks, refining prompt engineering, and disrupting traditional teaching models. The authors advocate for integrating GAI tools like ChatGPT into classrooms to enhance students' critical thinking, creativity, and understanding of complex concepts.

MIT's initiative [3] aims to educate K-12 students about GAI through project-based learning that integrates technical concepts with ethical design. The authors emphasize the importance of computational action and provide resources for a range of GAI-related educational activities to promote a holistic understanding of GAI's societal impact. UCLA [4] provides practical suggestions for integrating GAI into the educational process. The authors recommend assignments that involve GAI for fact-checking, draft generation, and prompt engineering. They emphasize the importance of critical thinking, digital literacy, and responsible use of GAI in education.

Researchers at the University of Chicago developed GAI models that improve predictions of scientific discoveries by simulating the scientific process. The models identify potential discoveries and explore new scientific territories, demonstrating how GAI can augment human intelligence and enhance research capabilities [5]. The article [6] examines the promises and implications of GAI in education, focusing on personalized learning, automated assessment, and the potential ethical issues. The authors propose frameworks for integrating GAI in educational settings to support personalized and adaptive learning experiences while addressing ethical concerns. The authors of [7] explore the transformative role of GAI in scientific research, highlighting examples where GAI has accelerated discoveries in various fields. They discuss the use of GAI in data analysis, predictive modeling, and automating routine research tasks, emphasizing GAI's potential to revolutionize scientific methodologies and innovation. The problem of using artificial intelligence tools in education and research was previously addressed in the publication [8], where the authors emphasized the need to develop policies that regulate the ethical use of GAI technologies.

Summarizing the research findings [8–13] and building upon the idea presented in [8], we will outline the advantages and risks of using generative artificial intelligence in education and research.

Advantages of GAI in education and research:

1. **Personalization and adaptive learning:** GAI technologies have the potential to tailor educational content to the needs of individual learners, enhancing engagement and effectiveness (Zawacki-Richter, Marín, Bond, & Gouverneur, 2019, [9]).

2. **Content creation:** GAI can automate the generation of educational materials, reducing the workload on educators and allowing for more dynamic curriculum development (Swanson, Moran, Lussier, & Fung, 2014, [10]).

3. **Enhancing research with GAI:** GAI facilitates the synthesis of large datasets into coherent summaries, aiding researchers in uncovering novel insights and accelerating the pace of discovery (Jamshidi et al., 2020, [11]).

Risks and ethical considerations:

1. **Dependence on technology:** overreliance on GAI for educational content and assessments may undermine critical thinking skills and reduce face-to-face interactions in learning environments (Arora & Arora, 2022, [12]).

2. **Bias and Fairness**: there is an ongoing challenge to ensure GAI technologies do not perpetuate existing biases found in their training data, especially in applications like grading and admissions (Burlina, Joshi, Paul, Pacheco, & Bressler, 2021, [13]).

3. **Hallucination effect:** GAI sometimes produces inaccurate or misleading information, a phenomenon known as "hallucination,". This poses a significant risk in both education and research, as such incorrect data can negatively affect the quality of educational materials and research outcomes (Varun Magesh and etc., 2024, [14]).

4. **Academic integrity and authenticity:** the ease of generating text with GAI raises concerns about maintaining academic integrity and the authenticity of student work. GAI can generate complete responses to assignments, which threatens the originality and independence of students' work and complicates instructors' ability to detect plagiarism or misuse of technology (Nelson & Creagh, 2023, [15]).

Upon reviewing the current practices of utilizing artificial intelligence in education [16], it is evident that there remains an ambiguous distinction between the permissible and prohibited use of GAI. Scholars and practitioners largely concur on the necessity of labeling GAI-generated content and acknowledging GAI contributions. However, there is a lack of consensus on the appropriate methodology for implementing these practices. The challenge lies in developing standardized guidelines that ensure transparency and integrity while accommodating the evolving capabilities of GAI technologies in academic settings.

The article addresses the following tasks: analyze the benefits of GAI in facilitating personalized and adaptive learning, automating content creation, and accelerating data synthesis for research. Identify and categorize risks associated with the use of GAI in higher education, and suggest strategies for mitigating these risks. Propose recommendations for ensuring transparency and accountability in the use of GAI-generated content in educational and research activities.

Research results and discussion. In order to fully understand the potential challenges associated with the adoption of generative artificial intelligence into educational and research environments, it is crucial to examine four key risks: overreliance on technology, the perpetuation of bias and fairness issues, the phenomenon of GAI "hallucination," and concerns regarding academic integrity and authenticity. Each of these risks highlights significant ethical, practical, and educational implications that must be carefully addressed to ensure responsible and effective use of GAI technologies.

Dependence on technology. Human dependence on technology can also have a positive effect. A striking example of effective human-AI interaction (technology) is the improvement in the skill level of Go players [17]. The victory of AlphaGo over Lee Sedol in the ancient game of Go is more than a milestone in the field of artificial intelligence; it has become a catalyst for the enhancement of human skills within the game. This landmark event demonstrated that when humans engage with GAI tools, they can extract valuable insights and strategies, thereby elevating their own level of play. The aftermath of the match saw a notable improvement in the performance of Go players worldwide, suggesting that GAI can serve as a sophisticated tutor, pushing human players to refine their abilities and explore new dimensions of the game that were previously uncharted or underappreciated. Such collaboration between human intelligence and artificial intelligence holds the promise of advancing expertise in a symbiotic relationship that benefits from the unique strengths of both.

Bias and fairness. Various methods and approaches have been developed to detect and minimize bias and fairness issues in GAI models. Although these methods are not yet widely adopted, the process of implementation is gradually advancing. These

techniques include the use of diverse training datasets, the incorporation of fairness constraints in algorithmic design, and post-hoc analysis of GAI outputs to identify and correct potential biases. As GAI continues to be integrated into educational and research environments, accelerating the adoption of such methods is essential to ensure equitable outcomes and to prevent the perpetuation of existing societal biases.

Hallucination. This effect is often difficult to detect, making it critical to develop strategies for identifying, mitigating, or eliminating hallucination in -generated outputs. When creating educational materials, conducting training sessions, or drafting regulatory guidelines, special emphasis should be placed on managing this risk. Strategies include improving the transparency of GAI outputs, incorporating human oversight, and establishing rigorous validation mechanisms to ensure the accuracy and reliability of -generated content.

Academic integrity and authenticity. The widespread use of GAI in content generation has ignited discussions about maintaining academic integrity and the authenticity of student work, particularly in the context of research. While essays may benefit from a distinct style that reflects the author's voice, the core value of research does not lie in stylistic elements, but in the strength of its arguments and the quality of the evidence presented. Thus, although proper formatting and presentation are important, the primary emphasis should be placed on the validity, originality, and authenticity of the research itself, rather than on achieving a specific writing style. This approach is essential to ensure that the scientific community continues to prioritize the integrity and credibility of research, even as content generation tools become more accessible. Nonetheless, we recognize that an author's style remains important in conveying unique perspectives, especially in certain types of academic writing.

Obviously, not every use of GAI leads to plagiarism or carries significant risks, so it's important to classify tasks by risk level, e.g., low, medium, high. The classification depends on various factors, including the potential impact on individuals or society, the likelihood of generating false or misleading information, and the sensitivity of the data involved.

In our publication, we analyzed how various universities approach the use of GAI and conducted an analysis of tasks where the use of GAI is either permitted or prohibited [8]. Here's a slightly expanded and nuanced classification that considers the broader implications and applications of these technologies (Table 1).

However, GAI is a rapidly developing technology, and as such, creating an exhaustive list of tasks where its use is either permitted or prohibited may not be practical. Instead, it is more effective to develop guidelines in the form of comprehensive policies that govern its application. Based on the research into permitted and prohibited practices concerning GAI usage, as well as the proposed risk categorization, we recommend the following policies:

1. The use of GAI technologies is **permitted without marking** for "commodity" tasks related to idea generation, conducting experiments, information search, machine translation, styling, grammar checking, data format conversion, and other tasks that do not create new knowledge or meanings. For example, machine translation using DeepL, Google Translate, Bing Translator, ChatGPT, etc., or checking style and grammar using Grammarly does not require marking the use of GAI.

2. The use of GAI technologies is **permitted with marking** in cases where the created content is a completed work or an important part without author adaptation. If a person created content using GAI and published it "as is," such action requires marking. However, if a person created content that was adapted and stylistically optimized to the

author's style, such use does not require marking and will not be considered a violation of integrity principles.

3. The author must remove any clear signs of GAI use from the final work. Since GAI evolves, the final intellectual product requirements and guidelines should be clearly defined to avoid confusion. If these signs remain, the work won't meet standards, even if GAI use was disclosed, as it could still breach integrity rules.

Table 1

Risk categorization of using generative artificial intelligence outputs

Risk Level	Direction	Definition	Examples	Rationale
Low to Medium	Text Transformation and Summarization	Operations that involve changing the format, appearance, or length of the text without significantly altering the underlying information or intent, including condensing texts or extracting specific information	Spell checking, grammar correction, summarizing articles, extracting key points or facts	These tasks are generally low risk but can veer into medium risk if the summarization or extraction process omits crucial information or context, leading to potential misunderstandings
Medium to High	Text Enhancement, Augmentation, and Analysis	Enhancing or augmenting text quality for clarity, engagement, or depth, and using GAI for interpreting or analyzing text data to understand, predict, or generate insights	Rewriting for clarity or style, enhancing descriptions, translating languages, sentiment analysis, intent recognition	These operations involve more complex manipulations of text and may introduce biases, alter meanings, or involve subjective interpretations. They carry a higher risk of impacting individuals or society, especially when applied to sensitive contexts or used to predict behavior
High	Text Generation	Generating entirely new content based on learned patterns, contexts, or prompts, with little to no human input in the creation process	Creating new articles, stories, reports, fake reviews, or news stories	This category remains high risk due to the potential for misuse in creating misleading information, impacting reputations, or influencing public opinion. The generation of new content carries inherent risks related to accuracy, ethics, and the potential for generating harmful or biased content

4. For tasks requiring logical or mathematical reasoning, as well as in sensitive fields such as medicine or law, preference should be given to GAI systems equipped with methods to counteract the "hallucination" effect. These methods may include advanced prompt engineering, reasoning-enabled models, or a combination of these approaches, with a mandatory indication of the techniques used to minimize risks. In sensitive areas, it is also essential to provide justification for using a particular GAI.

5. GAI may be used for data analysis, provided that results are verified with an alternative tool and/or by using software that includes program listings or links to public repositories (e.g., GitHub). When proprietary or fine-tuned models are used, detailed information about the dataset, training process, and key metrics demonstrating model reliability must be provided.

6. The use of GAI for handling personal, sensitive, and confidential data is permitted only when using corporate versions of models, open-source tools in on-premises environments, or other tools after data anonymization. Compliance with data security requirements is mandatory, with a strong preference for working with anonymized data.

7. When using datasets to train models, it is recommended to perform an additional analysis to identify any potential biases and to document the findings in the final output.

8. GAI tools can be used to create images, audio, or video, but unedited GAI output must be labeled "Created using GAI." If GAI is only used to improve existing content, like enhancing an old photo, labeling is optional. Details like the tool, model, or version can be included if relevant.

9. All information about the use of GAI should be described in a separate section titled "AI Acknowledgment.". Additional details like tool, service, model, version, etc. can be added if relevant.

10. Each organization should establish an action plan to address instances of improper labeling or other violations related to GAI usage, including steps for remediation.

Conclusions and prospects for further development. GAI offers significant benefits in education and research, providing new opportunities for enhancing learning, data analysis, and knowledge discovery. However, alongside these advantages are risks such as bias, data privacy concerns, and potential misuse. Addressing these challenges is crucial for building trust in GAI and ensuring its responsible application within academic and research environments. Our focus is on maximizing the positive impact of GAI while carefully managing these risks.

Looking forward, we are committed to refining our policies to make them clearer and more objective, reducing any subjectivity that could lead to inconsistent practices. This effort will also account for the rapid advancements in GAI technology, ensuring our guidelines remain relevant and adaptable. By concentrating on reducing risks, we aim to create a safe and ethical foundation for GAI in education and research, balancing innovation with responsibility and transparency.

AI Acknowledgment. This research article involved the use of ChatGPT 4o for low-risk tasks such as information search, grammar check, paraphrasing, and logical structure analysis. All key ideas, conclusions, and arguments presented in the article were formulated by the authors, ensuring that the integrity and originality of the research were maintained throughout the writing process.

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