



# What to consider before incorporating generative AI into schools?

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An emerging class of tools, colloquially referred to as “generative artificial intelligence” (GAI), can produce high-quality artistic media for music, literature, video, and animation. The most famous of these tools is ChatGPT, which has swept the world in less than a year. This is a phenomenon worthy of consideration by all educators. Generally, education is considered to lag behind emerging technologies, but GAI has a concurrent influence on education, production, and daily life. Today, GAI has evolved into a comprehensive application that can be tightly integrated with operating systems, browsers, and software to meet our daily educational needs.

As a large language model (LLM) that can create surprisingly plausible-sounding text in response to user prompts, GAI has already caused a cultural sensation in academia and education, especially as it threatens the future of homework assignments, exam-style questions, university essays, and research production. In July 2023, seven Chinese national ministries jointly issued a significant administrative document titled “Interim Measures for Administration of Generative AI”, which emphasized the principles of combining development and safety, as well as innovation and governance (Central People’s Government of the People’s Republic of China 2023). In September 2023, UNESCO released the “Guidelines for Generative AI in Education and Research”, which extensively analyzes the potential risks of GAI and delivers guidance for education practitioners. Audrey Azoulay, director-general of UNESCO, further stated that GAI cannot be incorporated into education without public participation and governmental regulation. Thus, we can infer that the development of GAI is a society-wide matter which involves multiple sectors including technology development, application, and regulation. Given the potential of GAI in academia and education, more matters need to be addressed

urgently by societal cooperation prior to upgrading GAI. This is demonstrated by the following aspects:

First, in terms of plagiarism detection, we should develop an AI classifier prior to upgrading GAI. Considering the major risks that GAI poses to scientific research, it is imperative for researchers and publishers to establish rules for using LLMs ethically. We think this is a decisive action which aligns with the “Recommendation on the Ethics of Artificial Intelligence (AI)” proposed by UNESCO. (UNESCO 2021) However, the above rules are limited in certain cases. Let us imagine that if an author generates a paper using GAI and manually corrects possible low-level errors, without listing GAI as an author or describing its use, editors and reviewers will not be able to identify whether it is an AI work. This will be one of the darkest moments in scientific development. To address such issues, we advocate the principles of “transparency and accountability”. Just as bibliographic databases frequently provide plagiarism-checking tools, the developer of GAI is responsible for developing reliable tools to distinguish between AI and human-written texts. For instance, although OpenAI has launched an AI classifier, the significant defects limit its use. To ensure the transparency of the AI system, the developer of GAI must optimize its AI classifier as soon as possible, which should take priority over the development of GAI tools. When this AI classifier matures, future scientific publishing will likely update the industry standards by adopting both plagiarism detection and AI text recognition.

Second, in terms of educational diversity, we should develop dedicated GAI systems for education prior to application. Contrary to academic writing where journal editors and reviewers act as gatekeepers, students’ use of GAI is a black box. Liberals believe that education should cultivate students’ individual knowledge and diverse ideas. Through GAI, students can deceptively pass off LLM-written text as their own for homework, exams, and even dissertations. Once children grow reliant on it, they can address problems requiring higher-order thinking without learning, which risks homogenizing the presentation of student knowledge and ideas. “If students start using ChatGPT, not only will

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they outsource their writing, but also their thinking”, warns Sandra Wachter, an Oxford Internet Institute researcher who studies technology and governance. To address such issues, it is crucial to develop AI classifiers for educational contexts that help teachers identify students’ plagiaristic work. Certainly, teachers would be more willing to adopt such AI classifiers if they were free and open source. What is more, technology developers should prioritize developing dedicated GAI systems for education. We have imagined the functionality of these systems. For instance, it should transcend the traditional “question–answer” mode, but rather adopt a “question-guidance” mode to effectively communicate with students. On this basis, these education-specific systems can be developed with a multi-user synchronized dialogue mode (i.e., group chat). Teachers and students can engage in group chat simultaneously. Students can ask GAI questions and discuss the generated answers. GAI can give further replies or guidance based on students’ discussions. Meanwhile, teachers can monitor and participate in real-time conversations between student–student and student-GAI. In this regard, this mode not only encourages collaborative inquiry and mutual guidance among students but also reinforces the vital role of teachers as mediators and supervisors.

Moreover, we advocate the delineation of application boundaries according to diverse learning stages. For instance, college students can decide whether to employ GAI tools independently. In primary and secondary schools, it is necessary to tailor usage guidelines according to distinct teaching goals, tasks, and methods. This includes categories such as “discouraged usage,” “moderate usage,” and “prohibited usage.” Considering that both GAI and children cannot take legal liability, we discourage the moderate usage of GAI due to its blurred and uncontrolled boundaries. Even with improved assignments and test formats, tasks at the K-12 level (particularly in the early grades) may not pose any challenge to GAI. Therefore, we support preventing children from using GAI as registered users. Just as the “Guidelines for Generative AI in Education and Research” suggested that the minimum age for employing AI tools in the classroom could be set at 13 years old. (UNESDOC 2023) Certainly, preventing children from GAI is not meant to exclude children from GAI. Alternatively, GAI could be considered an essential part of the AI courses. For instance, children can experience the features, functions, advantages, and limitations of GAI through the registered accounts of adults such as parents and teachers. Additionally, through GAI’s open interface, children could collect data and train AI models to learn deep learning algorithms and AI applications, and more importantly, understand relevant AI ethics, laws, and administration.

Third, in terms of educational governance, we should fulfill GAI’s positive roles prior to preventing negative impacts. We have provided upfront strategies for academia and education

from the perspective of GAI development and application. The next step is to emphasize technology regulation, which serves both as a supervisor and coordinator of technology development and application and also plays a key role in fostering a dynamic AI ecosystem. This role involves not only formulating operating rules for GAI developers but also providing application guidelines for GAI users. Regarding the regulation of GAI development, laws should be enacted to enforce compliance by technology developers with data training, processing, cybersecurity, and privacy protection rules. Regarding the regulation of GAI application, teacher training and curriculum standards should incorporate GAI education to enhance the AI literacy of teachers and students. Additionally, primary and secondary schools, universities, and administrations should collaborate on promoting exemplary cases to provide empirical references for the popularization of GAI. Furthermore, it is crucial to mitigate potential risks related to GAI misuse by integrating academic integrity, ethics codes, and examination regulation into the legislative framework. Incidentally, the descriptive style of these policy texts would be more “powerful” if they used less negative terms such as “correct”, “eliminate”, “manage”, and “regulate” and more terms such as “promote”, “guide”, “healthy development”, “improve”, and “govern”.

In conclusion, the development of GAI is a society-wide matter. The risks that GAI brings to academic and educational fields necessitate collaborative efforts from various sectors of society. In this regard, we call on primary and secondary schools, universities, administrations, and technical departments to work together to promote the future development of GAI.

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## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest. Our manuscript has no associated data.

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