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Reflections on how artificial intelligence advances the restructuring of education and teaching

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In today's world, information technology is evolving at an unprecedented pace. After undergoing phases of digitization and networking, humanity is now experiencing a new "breakthrough moment", stepping into the era of intelligence (Paliktzoglou, 2024).

On November 30, 2022, OpenAI launched ChatGPT, a groundbreaking conversational general artificial intelligence (AI) tool (OpenAI, 2022). ChatGPT has demonstrated impressive capabilities in language comprehension, generation, and knowledge reasoning. It excels at understanding user intent, engaging in effective multi-turn conversations, and providing responses that are comprehensive, focused, concise, logical, and well-structured.

The emergence of ChatGPT is widely regarded as a pivotal moment that could trigger a new wave of AI revolution, accelerating the advent of the intelligent era (McTear & Ashurkina, 2024). It is expected not only to reshape future industries but also to transform our production and lifestyles, potentially leading to profound societal changes. It may even bring about a paradigm shift across all domains of human experience and redefine humanity's role in the world (Zhang, 2024).

At the beginning of 2024, OpenAI introduced Sora, an AI model capable of generating video content from text descriptions (OpenAI, 2021). By learning from the real world, Sora simulates human ways of observing, depicting, and expressing the world, surpassing all previous capabilities of AI-generated content (AIGC). It produces video content that aligns with the physical reality of the world, marking another breakthrough in AI's ability to understand and represent the world.

In the face of such profound waves of transformation, education, as the cornerstone of social development, is not only inevitably subject to change but also a necessary and central element of this broad and deep revolution. Here, I would like to discuss three key perspectives on the urgency, depth, and breadth of educational reform in the era of AI.

REASSESSING AI

Breaking through the fundamental understanding of AI and education requires looking beyond the relationship between AI and education to consider the revolutionary impact of AI on education from the perspective of AI's relationship with society. This approach is essential for fully recognizing the urgency of educational transformation.

Thus far, the progress of science and technology has always been an extension and expansion of human physical abilities. The monumental achievements of the Industrial Revolution in human history, from the steam engine to electrification, can be regarded as extensions and amplifications of human physical capabilities, bringing revolutionary changes to people's lives and the development of society.

Information technology, on the other hand, has further extended and enhanced the capabilities of human sensory organs—hearing, vision, touch, and taste. The significance of AI lies in the extension and expansion of human brain functions, their replacement by machines, and the potential to surpass them (in fact, even complex intellectual creations such as art, once exclusive to humans, have now been deeply penetrated by AI).

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In this sense, the transformations brought by AI hold a significance equivalent to that of the Industrial Revolution for human society, and perhaps even surpass its impact. These changes represent a milestone transformation, distinct from and far exceeding the many technological advancements of the past, which, while making important contributions to economic and social development in their respective historical stages, do not compare to the profound shifts driven by AI.

It is worth noting that AI technology is not only directly related to education, as education itself is the transmission and cultivation of human intelligence, but also directly connected to production, daily life, the economy, and society.

It can be said that, to date, no technology has so closely linked education and society as AI has. No technology has simultaneously transformed both education and society while driving their interactive development. Clearly, with the advent of the AI era, rapid changes are occurring across the economy, society, production, and daily life, fundamentally altering the overall structure of society. As we have already seen, the deployment of thousands of autonomous taxis in Wuhan has had a profound impact on the taxi industry, particularly on the employment of taxi drivers.

If education fails to demonstrate the foresight and leadership it should possess, and does not evolve in interaction with society but instead falls behind and becomes obsolete, it will be a great tragedy for educators and an even greater disaster for society as a whole.

In fact, in the era of AI, it is foreseeable that jobs involving simple and repetitive tasks will be replaced by intelligent robots. Therefore, rather than worrying about the rise of autonomous vehicles, unmanned stores, unmanned hotels, unmanned banks, and other forms of automation, we should focus more on the distribution of the labor outcomes generated by these unmanned machines. This is undoubtedly a question of social systems, and perhaps also a question of social ethics.

Thus, we must deepen our understanding of the significance of AI in driving societal transformation, and in turn, recognize the demands AI places on education. We need to embrace AI in a more proactive manner, promote educational reform, and lead society forward.

RECONSTRUCTING TEACHING

We must move beyond viewing AI as merely a tool for education. It is not enough to consider AI's impact on education from the perspective of educational technology alone; we must also examine AI's influence on education from the standpoint of new productive forces and societal changes, and fully appreciate the profound nature of educational transformation.

Undoubtedly, AI technology is a form of digital educational technology, representing an advanced stage in its development.

The first phase of digital technology's application to education involved the digitization of teaching resources, such as converting texts, audiovisual materials, and images into digital formats. These digital resources are now widely stored on computers and have become integral to teaching and learning processes.

The second phase is the networked teaching stage. The internet and mobile internet technologies have made digital resources dynamic and have significantly enhanced their role in the teaching process. Massive open online courses (MOOCs) are a landmark achievement of this phase. This technological development not only facilitated the balanced regional development of education and promoted educational equity and quality but also, during the coronavirus disease 2019 (COVID-19) pandemic, helped billions of people avoid the disaster of having no access to education.

The third phase is the intelligent education stage. This represents a new revolution and qualitative leap based on the previous two stages and marks the advanced stage of digital education technology. As Professor Bie Dunrong from Xiamen University has stated, earlier digital technologies primarily addressed the diversification of how educational resources are presented, the massive storage and long-term availability of those resources, and the speed and convenience of access. However, educational technology itself lacked the capacity for learning and lacked human cognitive abilities. Its role was primarily instrumental. AI technology, by contrast, gives machines the cognitive abilities humans possess, and even the potential for attitudes and emotional intelligence. This will profoundly change the teaching and learning process.

The foundation of AI technology development lies in large model technologies, which are advancing rapidly. Based on these large models, we can establish large models for curricula and academic disciplines. Perhaps these large models will become a hallmark of the intelligent education era.

Even more profoundly, the new productive forces triggered by AI will reshape the global industrial structure and ecosystem. Correspondingly, the content of education in the AI era must also be reconstructed! Therefore, I believe that while AI's role as an educational technology is significant, we must not only focus on this; we must also recognize that the changes in educational content

represent fundamental shifts. In the AI era, we need to consider not just how to teach, but also what we teach, what students should learn, and how they should learn. There is much work to be done in this regard.

The educational transformation in the AI era is, of course, global in scope. United Nations Educational Scientific and Cultural Organization (UNESCO) has been closely monitoring AI's significant impact on education in recent years and providing support for policy and practice. In 2019, UNESCO emphasized the need to cultivate "the AI literacy skills required for effective human-machine collaboration" among teachers (UNESCO, 2024a). During the 2024 Digital Learning Week, UNESCO released the "AI competency framework for teachers" (UNESCO, 2024b) and the "AI Competency Framework for Students" (UNESCO, 2024c).

For teachers, it outlined five areas of competence, including human-centered values, AI ethics, AI fundamentals and applications, integrating AI into teaching, and supporting professional development with AI. It suggested categorizing teacher competencies into three progressive levels: Acquire, deepen, and create. For students, the framework proposed four key competencies: human-centered AI values, AI ethics, AI technology and applications, and AI system design. These were also divided into three progressive levels: Understand, apply, and create.

These global educational reform trends are highly relevant and worthy of our active participation, and we should contribute our efforts to this transformative process.

REBUILDING THE CAMPUS

To break through the limitation of viewing AI's impact on education solely in terms of the teaching process, we must examine AI's influence on education from the perspective of educational governance as well, fully recognizing the breadth of educational transformation.

From a teaching perspective, the impact of AI on educational methods and content is significant and profound. However, as mentioned earlier, AI's influence on education is all-encompassing, affecting key aspects such as talent cultivation goals, educational environment, teacher-student relationships, and campus management, leading to major changes and revolutions.

Regarding talent cultivation goals, for a long time, we have discussed talent cultivation models based on the concept of knowledge-ability-quality (KAQ), emphasizing the shift from knowledge-based education to ability-based education. However, in the AI era, when viewed from the perspective of knowledge, a single individual's grasp of data and knowledge pales in comparison to the capabilities of AI machines—much like a drop of water compared to the ocean, or an individual compared to humanity as a whole. From the perspective of ability, many repetitive tasks will be replaced by machines, while creative labor will become increasingly important. Yet, human quality (or character) remains irreplaceable. Therefore, in future education, the cultivation of human qualities will be even more crucial, both for the individual's personal development and for the construction of a harmonious and prosperous society. Accordingly, our educational philosophy and objectives must place greater emphasis on the importance of quality education.

In terms of the teacher-student relationship, the dynamic between teachers and students may change due to the involvement of intelligent robots. In the internet era, we have already recognized the shift from the traditional "dual-subject" relationship between teachers and students to a "teacher-machine-student" relationship. Professor Yang Zongkai has provided extensive discussions on this topic (Yang, 2024a; Yang, 2024b). At that time, machines were merely intermediaries and incapable of thinking. However, today, machines have gradually gained the ability to think, becoming a "third party" capable of playing an active role. They have evolved into robotic teachers or "study companions" for students. The emergence of the "third subject" will reshape the roles in university education and teaching processes, while also sparking innovations in educational theory (Bie, 2024).

Regarding learning environments, the development of AI in education, combined with further integration with mobile internet and other technologies, will lead to significant advancements in virtual classrooms and campuses. This will expand the reach of higher education, fulfilling the needs of a lifelong learning society where "everyone learns, everywhere, and at any time." However, at the same time, the unique value of physical campuses will be further highlighted. In the AI and virtual environment, the development of fundamental qualities necessary for a learner's holistic growth must still take place in the physical campus setting. Recent employer surveys show that employers are particularly dissatisfied with three aspects of current university graduates: communication skills, teamwork, and innovation (Xinjincheng Research Institute, 2024). Similar surveys abroad reveal that communication skills, cooperation, and creativity are areas where employers feel university graduates need to improve (Kevin, 2024). The physical campus is the best place to address these issues. A physical campus facilitates face-to-face interactions between teachers and students, as well as student-student exchanges, creating emotional connections and interactions that virtual environments

cannot fully replace. In the AI era, many transferable or soft skills still need to be cultivated in physical environments where human communication takes place. A person who only lives in a virtual world would struggle to adapt to the vibrant, real-world social life.

In conclusion, in the AI era, we need to focus on building two types of campuses: modern, intelligent physical campuses and virtual campuses.

CONCLUSION

In December 2022, at the Global MOOC and Online Education Conference, the "Infinite Possibilities—Report on the Digital Development of Global Higher Education," compiled by China's Ministry of Education, was released to the world (Official website of the Ministry of Education of the People's Republic of China, 2023). While it was still difficult at that time to fully estimate the fierce emergence and enormous impact of AI technology, the report accurately grasped the trend of digital development. The phrase "infinite possibilities" is not only poetic and romantic but also reflects a deep, hopeful vision for the future of education.

Indeed, AI can offer "infinite possibilities" for the development of education! We must embrace these infinite possibilities—not by simply going with the flow and taking a passive approach, but through proactive actions and the continuous promotion of urgent, profound, and wide-ranging reforms, all based on a clear understanding of the prevailing trends. Reform is the driving force behind social development, and it is the only choice for education to adapt to and embrace the future intelligent society.

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