Accelerated Move for AI Education in China

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Abstract

Purpose: This article summarizes recent developments in the use of artificial intelligence (AI) in Chinese education, paying particular attention to the different applications of AI at a number of different levels. The article reviews key government policies and guidelines and suggests a course for future development.

Design/Approach/Methods: The article analyzes key government policies relevant to the implementation of AI in Chinese education. Additionally, the article leverages the author's experience as a key member of national information technology curriculum development, which involved participation in the drafting of various curriculum standards and policy documents and discussions with numerous administrative officials, teachers, and researchers.

Findings: This article argues that the use of AI in Chinese education varies at different levels. AI implementation is at its early stage in elementary education; more prevalent in higher education, and even more common in the field of civic education. As a result, in multiple dimensions, Chinese students are becoming better trained to face an age of AI and working together to create an informatized education environment.

Originality/Value: This article describes how China is searching for the point where top-down system design meets bottom-up applications to chart its own course for the use of AI in education.

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Recent developments in artificial intelligence (AI) have garnered worldwide attention. Pressure from business and industry to transform has made every nation start paying attention to the changes AI technologies can bring to different fields. AI is becoming a new focus of international competition, and at the same time a new development opportunity, and even for humanity itself. As a developing country at a juncture such as this, China is taking another look at its resources—whether human, natural, data, or intelligence—and the relationships between them.

In July 2017, the State Council published the *Next generation artificial intelligence development plan* (State Council of China, 2017). This important state-level document expressed China's need to take every advantage of the great strategic opportunity presented by the development of AI, build upon the first-mover advantage China already has in the field, and accelerate its growth into a technological powerhouse of innovation. The report also made clear that AI should be broadly applied in basic education, higher education, vocational education, and civic education, and that China must train a new generation of talent skilled with AI. In October of the same year, the Communist Party of China (CCP) held its 19th National Congress. AI was the most representative technology field discussed at the meeting and was written into Xi Jinping's Report, confirming the elevation of AI to a field of highly strategic national import.

As a new age of AI approaches, China is looking at a variety of new strategies and new approaches for the field of education, with its sights on both the long-term and the immediate, basic education, and higher education, laying out a comprehensive AI strategy for a skilled workforce and for civic education. The country also has a large number of hi-tech enterprises actively participating in exploring how the use of AI can change education.

Beginning at the Beginning: AI Education in Primary and Secondary Schools

Elementary education is central to the question of what kind of people society wants to create, and AI has a fundamental impact. Training people who will not be replaceable by AI is a crucial problem that needs to be addressed.

As early as 2013, the Ministry of Education (MOE) kicked off a new round of revisions to the standard high school curriculum, putting more than 260 experts on the job for 4 years. Revision of the country's curriculum, standards, and textbooks was managed by the MOE, revealing the great significance of these revisions.

Among the revised standards is clear reference to "core competencies (*hexin suyang*)." This educational goal has been set under an environment of reflection on the relationship between AI and human intelligence, the collaboration between man and machine, and shared development of the future. Education in China is beginning to realize a transformation from the traditional systemic emphasis on the completeness of academic knowledge and the structure of that knowledge with an understatement of skill training to an equal weighting of raising students' abilities and the quality of their thinking to promote well-rounded development (Wang, 2019).

More directly relevant to the field of AI, the revised standards for the secondary education information technology curriculum include specific pedagogical content for AI. The revised high school IT curriculum no longer centers on computers and the Internet, instead focusing on data, algorithms, information systems, and the information society. The IT curriculum is not merely intended to eliminate computer illiteracy but rather to be a pathway for students to get acquainted with the world, to understand it, and to change it.

The high school IT curriculum has added an "AI" course worth two credits of 18 classroom hours each, for a total of 36 class hours. Through studying the AI course module, students learn about the concept and historical development of AI and can describe the process of realization of common AI algorithms. Through a module in which they develop their own simple intelligent technology applications, they gain hands-on experience with techniques and the basic process of designing and creating a simple intelligent system, strengthening their sense of responsibility in using intelligent technologies to serve human development. Through Science, Technology, Engineering and Mathematics (STEM) education, combining AI and the exploration of other courses to give students a thorough grounding in interdisciplinary thinking, the basic mode of thinking behind AI can permeate students' studies and everyday life. At present, new high school course materials are being developed based on the revised national curriculum standards. The new textbooks and methods are scheduled to go into use across the nation in several batches beginning in September 2019. The next step in curriculum reform to include AI will be the secondary education level, currently under consideration.

Extending AI education at the higher education level

At the higher education level, China is right now building an AI course environment and working to improve its execution, making course majors in AI available, and promoting the development of a top-level course of study in the field of AI. At pilot postsecondary institutions, colleges of AI are being set up and universities are working to increase enrollments in AI-related master's and doctoral programs. Up through May 2018, China had already established 32 colleges of AI. Universities research institutions are strengthening cooperation among academics, research, and production, and among AI courses, enterprises, and other institutions. China encourages those

colleges and universities with existing AI programs to expand their scope to establish "AI + *x*" compound majors and stress the cross-disciplinary integration of AI with mathematics, computer science, physics, biology, psychology, sociology, law, and other fields.

As the age of AI unfolds, higher education must both train professionals specializing in AI and help professionals in other disciplines to also understand, utilize, and integrate AI. Higher education sector in China is training multitalented professionals, both longitudinally versed in AI theory, methods, techniques, products, and applications and laterally knowledgeable of the use of AI in economics, sociology, management, law, education, and other fields.

Popularization of AI education

In the campaign to strengthen basic science education, China is broadly developing a variety of AI education activities to encourage technology professionals nationwide to participate in the effort to popularize AI education and increase the public's overall knowledge of AI, building, and improving all aspects of basic infrastructure for AI science education. The usefulness of all types of platforms for AI innovation is fully realized in science education displays and science museums.

In 2017, the Ministry of Science and Technology announced the first national platforms for the innovation and development of New Generation Chinese AI. These are the National Platform for Autonomous Driving (with Baidu), the National Platform for Medical Imaging (with Tencent), the National Platform for City Brain (with Alibaba), and the National Platform for Voice Recognition (with iFlytek). The setting up of development platforms by AI corporations and scientific research institutions is intended to open AI R&D up to the public sector and facilitate production. With these platforms, China can have AI competitions and all manner of scientific innovation and increase the participation of scientists in the spreading of AI education. China hopes to make education available to all its people to foster the gradual spread of programming and AI education and encourage the participation of all areas of society.

Future education to prepare for the age of AI

Looking at education from the perspective of AI development, the system in China is proactively adapting and preparing for challenges. Through elementary education, higher education, and civic education, the country is training a population to have the core skills, professional abilities, and intellectual consensus necessary to be prepared for an age of AI, and it is setting up the lifelong learning and employment apparatus necessary for an intelligent society of the future.

From another angle, AI is bringing an opportunity for individualization to the entire educational system. Many Chinese tech corporations are increasing the use of intelligent technologies to construct an educational system. A great variety of educational technology enterprises are actively exploring and broadly utilizing AI and other technologies to commence the building of "smart

campus" schools, develop online learning and education platforms that use Big Data intelligence, and promote the application of AI in mathematics, management, resource construction, and other areas. In April 2018, MOE published *Education informatization 2.0 action plan* (MOE, 2018). The Plan clearly noted the need to bring about shifts from dedicated resources to shared resources, from raising students' skill in IT applications to raising general IT attainment, and from integrated application to integrated innovation, and also to build a learner-centered education environment, provide precisely targeted educational services, and create "school credit bank" systems using innovative blockchain technologies, to make continuing education more flexible and customized.

Meanwhile, with the development of AI, continued advancements in voice recognition, gesture recognition, facial expression recognition, and brain wave recognition are providing new tools for educational research. Explorations of the application of these technologies in educational environments, their manner of application and their effectiveness are becoming the new direction of educational research. In 2017, National Natural Science Foundation of China added a new code (F0701) for educational research to encourage collaboration and integration between the natural sciences and the social sciences and to encourage the establishment of a new mode of interdisciplinary educational research.

There remain many areas of uncertainty. Imagined scenarios of machine intelligence persist. It is too easy for us to overemphasize potential short-term effects and discount longer-term import. Objectively, the basic technologies for AI have not yet produced any breakthrough advances in the past few years, but as computational power increases and integration in all facets of society drives a consolidation with production, popular knowledge, and application of AI is growing.

Education prepares people to face the future. What AI education really is and where it belongs remain questions to be explored. Ensuring that the interaction between AI and education is a beneficial relationship is especially important. Should either AI or education get too far ahead of or too far behind the other, the forces of production and relations of production fall out of step and become unable to take us to a new era.

Rome wasn't built in a day, and we cannot train a whole crop of AI professionals in one fell swoop. Reaching this goal will take long-term planning and several stages. In China, AI education has been planned out for different stages of schooling with the system being actively adjusted through a forcible, top-down approach. Proclaiming at the government level the importance of AI education makes it easier for China to grasp the important strategic opportunity presented by the field's development, and China's Internet companies are at the same time working to push and innovate to apply AI technologies in the educational system. The power of fields outside education, exemplified by corporations, with the help of AI technologies can more strongly force changes in the school system, putting the focus more squarely on users to build a new educational system. But at the same time, we need to be wary lest the surge in popularity of AI education leads to a new

mechanized form of the old rote system, or AI education becomes a device for competitive education and selective hiring.

Education will change with scientific and technological progress and developments in industry. As AI and education come to intersect, China is looking for a way to combine its top-down education system design with bottom-up teaching applications so that society as a whole might be fully prepared as it steps into the age of AI, to support every instance of personal development as we enter an age of intelligent systems, and to both create and nurture all those who will help build new-generation AI.

Declaration of conflicting interests

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