



A Conceptual Framework of Educational Social Experiment under Artificial Intelligence

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Abstract. At present, artificial intelligence has attracted the attention of governments and some groups all over the world and has put forward relevant development strategies. This paper introduces the basic situation of educational social experiments under the condition of artificial intelligence in some important countries and then briefly summarizes the progress in this field at home and abroad. On this basis, we imagine taking individuals, families, schools, and society as experimental scenarios, and then we construct a general framework of educational social experiment under the condition of artificial intelligence and explain some modules in detail, which makes up for the deficiency of the current experiment. Finally, we put forward the matters we need to pay attention to and the implementation measures to achieve this vision.

Keywords: Artificial intelligence · Educational social experiments · Implementation measures

1 Introduction

Countries such as the US, Germany, and Japan have identified AI as a national development strategy. For example, in February 2019, the US President signed Executive Order 13859, Maintaining US Leadership in Artificial Intelligence, which aims to promote and protect AI technology and innovation in the US. It pursues a comprehensive government strategy through international collaboration with the private sector, academia, the public, and allies. Federal agencies are required to prioritise R&D investments in AI, strengthen high-quality network architecture and data access, and ensure the nation is a world leader in the development of AI technology standards while providing education and training to build the foundation for a new era of AI in the US workforce resource pool. In June 2019, the US National AI R&D Strategic Plan 2019 (revised) was introduced, which can be divided into three levels, with the top 15 AI application areas, including education, all benefiting from the hold of eight specific strategic themes at the bottom and middle levels, and clearly prioritising investment in the eight strategies at the middle level as a prerequisite and foundation for the development of AI in education. For example, a focus on long-term investment in fundamental R&D can fuel the development of educational AI technologies; develop effective human-machine collaboration methods

to facilitate educational AI interaction and cooperation; focus on addressing legal and ethical issues to enhance the regulatory management of educational AI; design safe and reliable AI systems to ensure educational AI is transparent and trustworthy; create an open data environment to unlock the unlimited potential of educational AI; and develop AI standards To create an open data environment to unleash the unlimited potential of AI in education, develop AI standards and related tools to remove barriers to the development of AI in education, focus on the training of AI R&D personnel to ensure the demand for AI talent in education, and expand public-private partnerships to promote the accelerated progress of AI in education. To seize major strategic opportunities for AI development, build China's AI development advantage, and accelerate the building of an innovative country and a world power in science and technology, China's State Council's 2017 Next Generation AI Development Plan proposed AI education, using AI technology to accelerate the reform of talent training models and teaching methods, and build a new education system that includes smart learning and interactive learning. We will construct smart campuses and promote the application of AI in the whole process of teaching, management, and resource construction. In December 2021, China's National Informatization Plan for the 14th Five-Year Plan launched: "Carry out educational social experiments to study the impact of AI on educational models and objects, and explore the impact of AI integration into education on society". This is a major initiative, and China's series of strategies provide policy assurance for integrating AI into education. For example, in China, in order to maintain competition and sustainable development of artificial intelligence technology, the government has chosen some universities to strengthen and speed up talent training. The following is a popular talent training program in China, carrying out the so-called "Artificial Intelligence + Discipline Group Construction" plan, which is summarized through our survey. The basic idea is first to build a model framework, then propose some first-level evaluation indicators, and then set some sub-indicators under each indicator, so as to continue, and finally quantify as the basis for evaluation (Fig. 1).

*Note: Left, right and lower submodules of each circle module can also be subdivided. For example, **scientific research** can be subdivided into the number of monographs (books), the number of authorized and applied invention patents (books), the number of provincial and ministerial level and above science and technology awards (books), etc.*

2 A Brief Review of the Research

To accelerate the building of an innovative country and a world power in science and technology, and to promote education reform in the AI era, a systematic understanding and study of current education reform, as well as the scientific and rational design of educational social experiments and implementation strategies, are the core issues facing education reform and the development of various countries around the world. To this end, this is an introduction to the results of research done by scholars around the world in this area.

Yang Xin (2021) based on the Education Informatization 2.0 Action Plan and the essence, effectiveness, and advantages of AI, the innovation of the deep integration of the two is summarized as using AI to promote the renewal of education concepts,

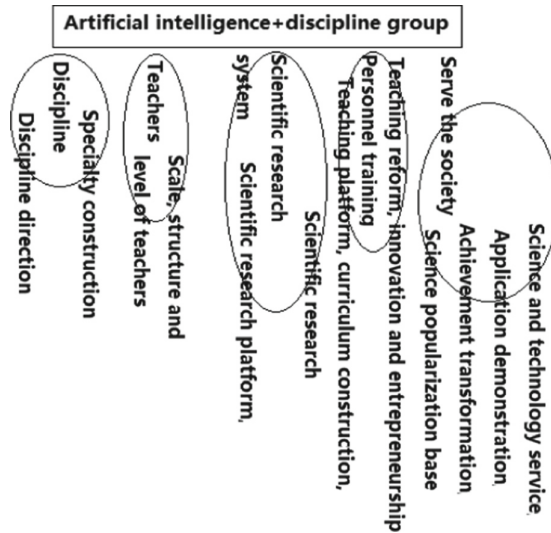


Fig. 1. Conception of AI Discipline Group in Universities

mode change, and system reconstruction [1]; Ferman, Bruno et al. (2020) conducted a field experiment to investigate two technologies that allow teachers to outsource grading and feedback tasks to writing practices [2]. The first technology was a fully automated assessment system that provided instant grading and feedback. The second used a manual grader as an additional resource to improve marking quality and feedback in areas where the automated system may have fallen short. Both techniques significantly enhanced students' essay marks, while additional input from human graders did not improve validity. In addition, these same technologies helped teachers engage more frequently in non-routine tasks supporting pedagogy's personalisation. The results illustrate the potential of AI to expand the set of automatable tasks and how advances in AI can transfer tasks that cannot be performed by human labour to automation; Lu Xing, Huang Rong-Huai (2022) point out that educational social experiments play a role in enhancing the understanding of educational reform pointed out that educational social experiments play an epistemological role in improving the knowledge of educational reform [3], providing methodological guidance for practical interventions based on deepening the understanding of contemporary educational reform; Tong, Lili, Zhang, Chen and Huang, Ronghuai et al. (2022) proposed a research scope and design framework for educational social experiments, systematically discussing the five categories of experimental objectives-environmental organization-methodological system-measurement tools-application feedback. The five experimental aspects, namely experimental objectives - environmental organization-measurement tools-application feedback, were systematically discussed, and the application direction of the experimental results was interpreted by taking the experiment of testing and exploring intelligent educational applications that promote a good fit between computational intelligence and cognitive laws as an example [4]. The experiments are designed to explore ways to scientifically measure the real social impact of AI applications in education; Michael J. Reiss (2021) argues that AI

is increasingly crossing traditional boundaries such as ‘school and home’ in learning, and that AI offers the promise of increased personalisation in education. AI education systems will focus on a narrow conceptualisation of education so that acquiring knowledge or a limited set of skills will dominate is dangerous but benefits students with special educational needs. As can be seen, AI-based learning faces significant implementation challenges, with technical challenges in adapting to user feedback and modifying core standards or content changes. Autonomy may disadvantage children who are less self-regulated or have little educational support at home and may exacerbate the achievement gap [5].

From the research results achieved above, it is clear that the emphasis on the importance of AI social experiments in education has focused on theory, but not enough research on specific experiments; AI education experiments are mainly targeted at full-time students, with little research on education for all; there is a lack of strategic vision and operability for implementation measures; and there is not enough research on the hazards and prevention of AI education. Social experiments in education need to be supported by rigorous design and scientific methods, and it is more challenging to explore causal inferences than to present descriptive inferences. Social experimentation in the education approach itself is also challenged by issues of experimental ethics, reproducibility, and consistency of results. Therefore, as seen from the preceding analysis, it is of great theoretical and practical significance to explore and propose solutions for conducting social experiments in education under AI and measures to ensure the smooth implementation of experiments.

3 Social Experimentation in Education under AI

As AI becomes increasingly popular and widely applied, countries and regional organisations are committed to formulating strategies for social development under AI and policies for the governance of AI. While maximising the benefits brought by AI, there is an urgent need to find solutions to the ethical and social issues surrounding AI. Active and informed governance of AI technologies is currently a priority for many governments worldwide. To clarify the social experimentation in education under AI [6], we first briefly identify the concepts of AI education and educational AI, as well as the concept of social experimentation. Artificial intelligence education, also known as smart education, is an intelligent education for all in an AI multi-level education system. In contrast, educational AI, which brings together teachers, content, and tools to provide learners with a ‘personalised’ intelligent educational teaching and learning ecosystem, has been controversial regarding the definition of social experimentation. Still, it is a way of testing specific political, economic, and technological factors and introducing them into real societies. The definition of social experimentation has been controversial. Still, it is a basic method for evaluating public projects that test the effects of introducing real social situations due to specific political, economic, and technological factors. It can undoubtedly provide a research pathway for studying the impact of artificial intelligence on education and exploring social development in the age of intelligence. Social experiments are conducted by randomly assigning participants to experimental and control groups, thus examining the impact of social programmes on participants.

Thus, social education experiments under AI conditions refer to a new path in providing a knowledge base for circular argumentation in response to the comprehensive impact of AI on society, further expanding the research horizon of science and technology policy from focusing on the changes brought about by technology in the objective world to concentrate on the changes in the subjective world of human beings caused by technological development. Therefore, to ensure that the AI education social experiment is carried out smoothly, it is also important to propose scientific and operational solutions, as well as implementation measures for the experiment. Therefore, the educational social experiments under AI currently conducted are not only of profound historical significance to a country's development strategy, strength, and prosperity but also of practical significance.

To achieve the goals of the social education experiment under AI conditions, it is urgent to develop a number of corresponding programmes, implementation strategies, and measures that are adapted to the changing environment for possible problems. With regard to implementation strategies, the so-called 5W2H analysis (Seven Questions Analysis), pioneered by the US Army Ordnance Repair Department in World War II, provides a good illustration of implementation strategies: ① WHAT - what is it? What is the purpose? What work is being done?; ② WHY-→Why do it? Can it not be done? Are there alternatives? ③ WHO-→Who? Who will do it? ④ WHEN-When? When should it be done? What is the best time to do it? ⑤ WHERE- Where? ⑥ HOW-How can it be done? How to improve efficiency? How to implement it? What is the method? ⑦ HOW MUCH-How much? To what extent? What is the quantity? What is the level of quality? What is the cost output? This is a framework with general applicability, but when coming to a specific design, it needs to be visualised specifically for specific scenarios.

Therefore, we need to proceed under certain assumptions to study social experiments in education under AI [7].

Firstly, social experiments in integrating AI and education, like scientific experiments, can be scientifically designed and have testability, and can also be evaluated for effectiveness.

Secondly, for experiments, it is certainly possible to develop strategies to ensure their smooth implementation and regulate them to achieve satisfactory results.

To carry out social experiments in education under AI, we must identify the main elements of its focus and must not do everything. For example, the first important thing is the design of the AI education social experiment scheme; then the development of practical implementation strategies, we envisage that we can also incorporate the tracking and early warning mechanism of the social experiment in the process of experimentation, i.e., the mechanism of correction and error correction in the process of experimentation; then we should have countermeasures and preventive mechanisms for the hazards of AI education; finally, the implementation of strategies for social experimentation under AI, we should conduct Effectiveness evaluation.

And to carry out social experiments in education under AI, we should also set specific goals. To this end, we believe that it is important to conceptualise a general analytical framework of better implementation strategies corresponding to educational social experiments under AI; secondly, it is necessary to outline the specific characteristics of AI educational social experiments and examine the matching and effectiveness of

systems and mechanisms to the implementation strategies; not only to design scientific experimental methods and steps, but also to propose operable implementation plans for the smooth running of the experiments In addition, it is also necessary to design and improve the policy recommendations and possible paths for AI education social experiments [8].

Carrying out educational social experiments under AI is currently an important matter for countries around the world, and there is no doubt that we all face huge challenges that require innovation in any case. Current experiments seem to emphasize full-time schools, but experiments under the vision of education for all are undoubtedly necessary, because knowledge updating, and social development is inseparable from education; therefore, the implementation strategy of the experiment should be able to be adjusted in time with the changing environment; carry out experiments, research AI education hazards focus on prevention research, will reduce the hazards to a minimum is also the key goal of the success or failure of the experiment.

4 An Education Social Experimentation Framework under AI

Education social experimentation framework under AI, the construction of a general framework for experiments to guide the normal conduct of experiments, which is clearly indispensable and important. Here, our vision is to construct an experimental scenario of AI education in which the individual, family, school, and society (including the inaugural unit) are four-in-one. In any case, however, it is essential to maintain a human-centred approach and to make AI education as enjoyable as possible. The following is a sketch of the framework we envisage (Fig. 2).

Where society refers to communities, enterprises, institutions, etc.; The specific experimental early warning mechanism modules are [9].

1. Conceptualise the system as a network of objects with overlapping components.
2. Identify the objects that are critical to the operation of the system.
3. Identify the key organisations and processes involved in these objects.
4. Look for indicators within these objects that might indicate that a problem has originated.
5. Perform a horizon scan (HS) to identify early warning signs of problems.

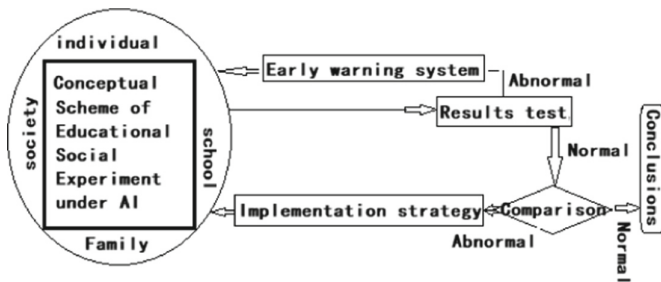


Fig. 2. Conception of the educational social experiment

6. Assess the system's ability to recover, resist, and adapt to these problems.

Note: These six steps are carried out sequentially, essentially an iterative and parallel process, with the 'late' process feeding back into the 'early' process. For example, the degree to which the network can withstand problems with a critical object (step ⑥) partially helps to determine the amount of resources that should be allocated to the (other) indicators in the search for that object (step ④).

During the experiment, it is important to focus on distillation and summarisation. This is done specifically by focusing on mechanism analysis, i.e., exploring the mechanism of operation of typical pilot units or typical cases and events; establishing connections and explanations among seemingly unrelated phenomena; refining the experiment and the abstract relationship between theory and experiment; finding key elements and core variables, and making appropriate analyses and explanations of them; and gradually moving from the surface to the inside, from the particular to the general, through cyclical repetition and revision, to achieve theoretical. The process is a continuous one. Moreover, such a process is iterative, but only if the experiment is scientifically designed [10].

In order to do a good job of social experimentation in education, we must.

1. Figure out the impact of AI on educational models and educational objects.

Therefore, we should explore the mechanism and pathways of the impact of the new teaching model under AI on knowledge acquisition and ability development; analyse the impact of AI integration into the teaching process on the classroom teaching atmosphere, teacher and student role positioning, teaching materials and teaching methods, and classroom teaching effects; study the impact of AI on learners' bodies and minds, and analyse the impact of AI educational applications on learners' social interaction, especially their ability to empathise with others, and other issues.

2. To clarify the impact of AI integration into education on society.

Pay attention to the impact of AI on the digital divide, analyse the prevention and control mechanism for the derivation and expansion of the digital divide, and explore effective strategies for bridging the digital divide; actively go about exploring issues such as the effective path for AI to solve the contradiction between supply and demand of education resources, the efficient supply mechanism of quality education resources under AI, scientific allocation methods and accurate service models.

3. Search for the essential laws of AI acting on education and promote high-quality development of education.

4. To propose actionable implementation strategies for social experiments in education.

5 Conclusions

Science and technology are a "double-edged sword". It is necessary to conduct research on social experiments in education under AI. It is essential to study and prevent the potential risks of AI development. It is indispensable to ensure that AI is safe, reliable, and controllable. It is incumbent to integrate the strengths of multiple disciplines and to strengthen research on legal, ethical, and social issues related to AI. Also, it is required to establish and improve laws and regulations that guarantee the healthy development of

AI. In order to ensure the safe, reliable, and controlled development of AI, it is necessary to integrate multidisciplinary forces and strengthen research on legal, ethical, and social issues related to AI and to establish and improve laws, regulations, institutional systems, ethics and morals that guarantee the healthy development of AI. This paper introduces a framework concept for social experimentation in education under AI. The first task we face is realizing it in the subsequent work.

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