



Research and Practice on AI-driven Courses Reform under the Perspective of Education 4.0

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Abstract. Personalized, intelligent, interactive, and open learning are the hallmarks of Education 4.0, a new, student-centered educational paradigm. With the goal of better-preparing students for upcoming developments in the learning process, it is an innovation and reform of traditional education. Through the study of AI technology from the perspective of Education 4.0, this paper aims to address how to empower the teaching reform of the course from multiple areas, including teaching objectives, teaching content, teaching methods, practical teaching, and teaching assessment. Improving students' professionalism and practical skills as well as the efficiency of teaching and learning are the ultimate objectives.

Keywords: Education 4.0, AI-driven, Course reform.

1 Introduction

The reports “Schools of the Future: Defining New Models of Education for the Fourth Industrial Revolution” [1] and “Catalysing Education 4.0: Investing in the Future of Learning for a Human-Centric Recovery” [2] released by the World Economic Forum in 2020 and 2022 described the global framework, characteristics and methods of Education 4.0. The Organization for Economic Cooperation and Development(OECD), in its report predicting the future of education in 2030, also clearly states that the direction of education should be responsive to the times.

Currently, there are many studies on AI technology-driven changes in higher education[3,4], such as AI ethics education[5], Generative AI [6,7], and AI Chatbots[8]. In China, [9] combines the practice of Zhejiang University, focuses on the construction of the ecological system architecture of higher education wisdom teaching based on AI technology from the perspective of ecological construction, [10] gives an overview of the academic seminar “ChatGPT and Future Education” held on March 4, 2023, at East China Normal University, and [11] puts forward a personalized teaching methodology of program design courses based on student development-centered and tailor-made

teaching concepts. It can be seen that from the perspective of Education 4.0, AI-driven education has become an important research direction.

2 Analysis and Research

2.1 Student Situation Analysis

In the learning process of the course, the student's learning situation presents the following characteristics:

(1) Insufficient learning interest and motivation: the knowledge of the course is dry and the concepts are abstract, some students are not interested in learning the course, and they lack the initiative and motivation to learn, which leads to poor learning results.

(2) Lack of innovative ability and critical spirit: knowledge and vision are limited within the classroom, and there is a lack of cognition of the future and the world. Students should actively embrace the new era and should look at new AI technology.

(3) Teamwork ability needs to be strengthened: in group discussions and experimental classes, teamwork as well as organizational and management skills of some students need to be improved, and the cultivation of leadership, communication and collaboration skills needs to be strengthened.

(4) Experimental skills and practical ability need to be improved: although students have been exposed to some basic experimental skills and computer application knowledge, they show certain deficiencies in the experimental classes of the course.

2.2 Education 4.0

Education 1.0, that is classroom learning. Education 2.0, that is, community learning and project-based learning, is advocated by the reform of quality education. Education 3.0, that is, socialized learning[12].

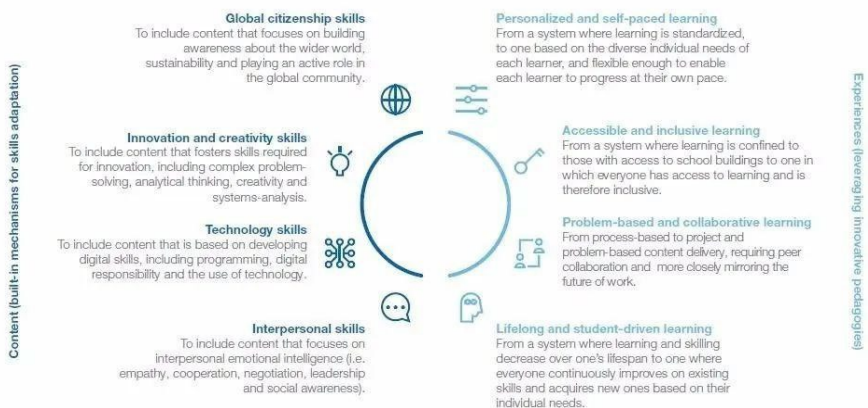


Fig. 1. The World Economic Forum Education 4.0 Framework [1].

On January 14, 2020, the WEF released the first initiative of Education 4.0 in [1]. The white paper is the result of a global consultation initiated by the WEF's Platform for Shaping the Future of the New Economy and Society, which seeks to identify promising models for quality education and to transition all education systems to an education system designed for the fourth industrial revolution - Education 4.0. The WEF Education 4.0 Framework contains 8 key shifts, as shown in Fig. 1.

3 Reform and Practice

3.1 Teaching Philosophy and General Innovative Ideas

Combining learning situation analysis and pain point analysis, as shown in Table 1, the teaching philosophy is: Student-centered and teacher-guided, this approach integrates multimodal resources to enrich content. It is employment-oriented, using industry collaboration to introduce engineering cases that boost motivation and interest. Combining virtual and physical simulations tightly links theory with practice, while promoting academic competitions and extracurricular projects to enhance practical skills. The AI-enhanced classroom leverages AI for teaching, evaluation, and digital human interactions, engaging both teachers and students. Enhanced interaction and group discussions improve participation and professional quality. Process-oriented, comprehensive evaluation provides feedback to elevate teaching quality.

Table 1. Teaching philosophy and general innovative ideas.

Objects	Pain Points	Innovation	Practice
Knowledge	Monotonous content lacks personalization	Enriching resources	Multimodal fusion
		Systematize knowledge	Knowledge map
		Personalized learning	AI Expansion
Skill	Passive method leads to poor skills and competitiveness	Employment-oriented	Case-driven projects
		Practice-oriented	V&R experiments
		Interest-oriented	AI-driven innovations
Profession	Simple process lacks professional cultivation	Thought leadership	Ideological construction
		Quality first	Career shaping
		Keep trendy	Embracing AI
Evaluation	One-sided evaluation lacks comprehensiveness	Whole process-oriented	Multi AI Evaluation

3.2 Optimized Knowledge System

Optimized knowledge system of the course to be more multimodal, systematic, and intelligent.

Create and make use of a variety of resources to create multimodal teaching materials, such as MOOC or SPOC courses, smart online classrooms, and experimental train-

ing bases. Adopting “knowledge mapping” technology to build a visual knowledge system and reform a systematic content framework to help students transform from fragmented knowledge to systematic thinking.

AI-assisted teaching to expand subject horizons. AI resources include Kimi, Deepseek, COZE agent, AI assistant Starlet, Jimeng AI Digital Man, and so on. The AI assistant not only expands subject horizons but also enables 24-hour self-service Q&A and personalized learning.

3.3 Enhancement of Practical Skills

From the perspective of Education 4.0, to better adapt to Industry 4.0, students must enhance their skills through the following initiatives:

(1) Employment-oriented and project guide. Integrate career guidance and practical projects into the curriculum to boost motivation and interest. Design courses with real-world applications to develop comprehensive abilities.

(2) Combination of virtual and reality. Utilize virtual simulation platforms for initial design and debugging, followed by physical operations. This approach enhances efficiency and safety.

(3) Project-Driven Activities. Encourage participation in extracurricular projects and competitions. Maintain industry connections to provide relevant training and foster practical skills. Stimulate students' interest.

These initiatives aim to create a responsive educational environment that prepares students for Industry 4.0. With the vigorous development of AI technology, simulation experiments, academic competitions, and engineering projects are actively embracing AI technology. Therefore, when improving students' practical ability, it is also necessary to use AI tools.

3.4 Cultivate Professional Quality

The cultivation of demand-oriented comprehensive professional quality. Professional quality refers to the inherent norms and requirements of the profession. It is a comprehensive quality shown in the professional process, including professional ethics, skills, behavior, style, and awareness. In implementation, emphasis is placed on coordinating teamwork, communication, organizational management, and practical technical abilities. Diverse classroom teaching methods engage students actively, fostering collaborative spirit and communication skills.

In the AI era, early understanding, familiarity, and utilization of AI are essential for college students in the new era. These skills are crucial for future development and align with the principles of lifelong and student-driven learning under Education 4.0.

3.5 Process-oriented and AI-driven Multi-evaluation System

All learning tasks are disseminated via an online platform to foster a sense of student engagement. Pre-class autonomous learning is initiated through courseware, videos, and AI-based pre-assessments. In-class dynamic feedback is facilitated by intelligent

interactions and a blend of virtual and real elements. Post-class practical application is reinforced through experiments and AI quizzes. The final assessment emphasizes the integration of higher-order abilities. Throughout this process, AI-driven process evaluation and personalized guidance are integrated. This approach transforms traditional single assessments into a diversified process-oriented assessment, ultimately achieving empowerment that transitions from knowledge to innovation capability, as shown in Fig.2.

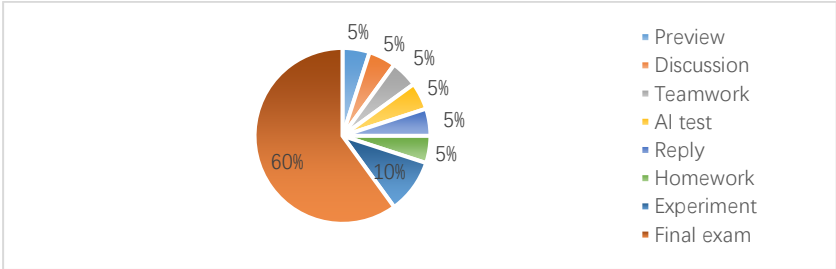


Fig. 2. Course evaluation system.

4 Conclusions

Education 4.0 represents a novel educational paradigm that is student-centered and marked by personalized, intelligent, interactive, and open learning experiences. It signifies innovation and reform of traditional education, with the goal of better-equipping students to adapt to future learning trends. This paper explores how to empower teaching reform in the course from several dimensions, including teaching objectives, content, methods, practical teaching, and evaluation, by studying AI technology through the lens of Education 4.0. It is evident that under Education 4.0, AI-driven education has emerged as a significant research direction. However, the existing literature contains relatively few studies that specifically focus on AI technology within the course context. The course team, in line with the new engineering curriculum construction goals, focuses on teaching pain points through learning situation analysis and actively explores innovative teaching measures, which have achieved remarkable results.

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Disclosure of Interests

The authors have no competing interests to declare that are relevant to the content of this article.

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