The Teaching System Construction of Artificial Intelligence Fusion Discipline Direction of Electronic Information in the Context of New Engineering

Shaojiang Liu[a], Zhiming Xu[b], Feng Wang[c,*]

Guangzhou Xinhua University, 248 Yanjiangxi Road, Machong Town, Dongguan, Guangdong, China

[a] mrliuxinhua@xhsysu.edu.cn, [b] xujay@xhsysu.edu.cn, [c] iswf@xhsysu.edu.cn

*Corresponding author

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Abstract: Amidst the development of the new engineering discipline and the construction of world-class engineering majors, the Electronic Information category has undergone multi-level deepened teaching reforms in this context. Especially with the application of new technologies and the advent of artificial intelligence products based on large language models, a diverse range of applications are flourishing in the market. This not only impacts various aspects of societal life, but also affects the development of education. Engineering majors need to integrate knowledge in the field of artificial intelligence under such an opportunity and drive the advancement of the discipline, playing an active role in guiding the direction of the discipline. A teaching system that is compatible with the integration of AI disciplines under the new engineering background should be constructed, incorporating political ideology education. From various aspects, teaching reforms should be strengthened to enhance the cultivation of high-quality, innovative, and specialized talents.

1. Introduction

On April 2, 2018, the Ministry of Education's Office disseminated a notice announcing the 'Higher Education Artificial Intelligence Innovation Action Plan.' It called for universities to prioritize the intersectional integration of artificial intelligence with computer science, control engineering, and mathematics[1]. With the emergence of novel engineering disciplines, Artificial Intelligence (AI) ascended to become the most sought-after newly introduced major that year. The evolution of university specializations often mirrors societal talent needs. In March 2019, the Ministry of Education sanctioned 35 universities to incorporate undergraduate programs in artificial intelligence, marking the inaugural large-scale endorsement of AI programs in China. In 2020, 180 universities received approval to add AI programs; in March 2021, the count was 130 universities; and in 2022, 95 universities, solidifying AI's status as the major attracting the highest number of new additions. This year, 35 more institutions joined the roster. Other trending majors encompassing intelligent manufacturing and big data further underscore the escalating demand for AI-centric curricula. Traditional engineering majors are feeling the ripple effect. In this landscape, devising effective strategies to meld artificial intelligence into distinct majors has become a pivotal concern for each discipline. The evolution of new systems is an inescapable trend, and to facilitate the growth of new engineering disciplines, focusing on teaching specific AI application technologies within existing majors, enhancing the professional development quality, and smoothing the transition from traditional to new engineering majors are of the essence.

An increasing number of undergraduate majors are integrating AI-related courses. However, initial AI courses often remain rudimentary, providing scant beneficial enrichment to engineering majors. The AI curriculum structure is multifaceted, spanning fundamentals to applications, necessitating extensive study and assimilation. The learning trajectory, extending from mathematics to model development, especially concerning AI development history, basic concepts, knowledge representation, inferential methods, diverse search strategies, and AI application areas, might seem

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monotonous to students in application-focused undergraduate programs. The AI curriculum's interdisciplinary character, its wide-ranging knowledge scope, rapid updates, and multiple research directions, often make it challenging for students to attain profound comprehension. Demonstrating the intrinsic value of AI courses poses a substantial challenge to educators. Particularly while learning AI, a solid foundation in mathematics and programming is crucial. The establishment of a solid foundation and the intensification of practical application are indispensable stages. Thus, the construction of a holistic teaching system is paramount. Rationalizing the incorporation of AI instruction into non-AI disciplines necessitates strategic planning and cross-integration with existing disciplines against the backdrop of new engineering disciplines to augment the quality of education. Based on the foundational theoretical insights offered by instructors, and acknowledging the deficiencies in the AI course teaching methodology, we should endeavor to establish a teaching system that aligns with the AI direction within the electronic information category, hone students' practical problem-solving skills, and contemplate the deep integration with related disciplines. In the current era of extensive language model product applications, it is increasingly critical to bolster the knowledge of AI industry applications in professional disciplines and provide students with a comprehensive understanding of AI principles. To further blend professional education from a broad spectrum of disciplinary knowledge, it is equally important to address the challenges in AI instruction and student learning. Overcoming these learning impediments is also a prerequisite for fostering the cross-depth integration and development.

2. The Practical Significance of Restructuring the Teaching System for Electronic Information Disciplines

In 2017, the Development Strategy Seminar for Engineering Education in Comprehensive Universities was held at Fudan University, leading to a consensus on the construction of "New Engineering" at the institution. The Ministry of Education has actively promoted the construction of "New Engineering", successively forming the "Fudan Consensus", "Tianjin Action", and "Beijing Guidelines", and issued notices on "Conducting New Engineering Research and Practice" and "Promoting New Engineering Research and Practice Projects", initiating the "New Engineering Research and Practice" project. The concept of "New Engineering" has become an important topic of discussion in universities. The primary goal of "New Engineering" talent cultivation is to preemptively plan for the cultivation of compound innovation and entrepreneurship talents in interdisciplinary and cross-disciplinary fields in the new round of scientific and industrial revolutions, address the significant talent gap in future industrial development, and upgrade the knowledge structure and cultivation system of traditional disciplines. Surrounding the construction of new engineering disciplines, the Ministry of Education has not only approved new engineering disciplines such as big data, artificial intelligence, and cyberspace security, but also provided new avenues for introducing new technologies into the construction of traditional engineering disciplines through industry-university-research collaborative education projects, promoting the transformation of traditional engineering disciplines into new engineering disciplines. The continuous investment and construction of new engineering have achieved good results, giving birth to many first-class disciplines and first-class majors, rejuvenating traditional engineering, and cultivating a batch of excellent talents.

On November 30, 2022, OpenAI released ChatGPT (Generative Pre-Trained Transformer), which immediately aroused widespread attention and heated discussions across society, and has already begun to influence all aspects of social life. This was followed by a profusion of large language model products, and various applications were born. From the initial question and answer function, it gradually evolved to image and video applications, from text to various multimedia applications, assisting in office work, and solving various difficult problems. Various powerful functions have also raised concerns, especially ethical issues triggered by students using GPT to complete homework and papers, which caused a chain reaction. Of course, it also affected contemporary teaching and brought about uncertainties in education. There are both positive and negative aspects. How to promote the rational development of education under such a sudden

impact is a problem that needs to be deeply explored and considered. In terms of higher education development, under the backdrop of new engineering, how to reconstruct the teaching system of electronic information disciplines based on the application of large language models is worth discussing. We need to integrate artificial intelligence into disciplinary development and increase application courses of artificial intelligence in the major. This will guide students to accept and adapt to the teaching system under the new situation.

3. Construction of the Teaching System for Artificial Intelligence Integration in the Major Field of Electronic Information

Taking the construction of New Engineering as an opportunity, strengthening the construction of artificial intelligence in major fields of electronic information, the goal is to integrate artificial intelligence into traditional discipline directions, aid the construction and development of disciplines, and establish a new teaching system.

3.1. Revision of Courses in Talent Training Programs

Under the impetus of the new engineering discipline, strengthen the construction of majors, rationalize and upgrade the original electronic information majors, and add the direction of artificial intelligence as well as increase the number of related courses. In the era of artificial intelligence, with new thinking, methods, and requirements, we plan measures to cultivate application-oriented talents in the cross-direction of artificial intelligence, striving to create first-class electronic information majors, and establishing first-class courses in artificial intelligence. The establishment of courses is a key link in talent cultivation. We continue to promote the construction of New Engineering on four levels: basic theory, strengthening practice, capability enhancement, and adapting to demands. In professional construction, we highlight the cross-disciplinary nature of artificial intelligence, emphasize practical operation, update advanced technical knowledge, and focus on building a good artificial intelligence interdisciplinary education and teaching platform to promote the development of original majors through basics and interdisciplinarity, satisfy the cultivation of application-oriented engineering talents, adapt to market demands, and accurately enhance students' qualities, capabilities, and knowledge. The existing directions such as embedded systems, the Internet of Things, etc., can apply artificial intelligence technologies more deeply, and the knowledge points of professional courses can be reconstructed. Artificial intelligence has a wide coverage and involves many fields, which can propose more innovative points of application, greatly promoting the development of the discipline.

3.2. Enhancing the Quality of University Students' Innovation Projects

Guided by university student projects, we promote the implementation of artificial intelligence-oriented projects, especially some key areas of projects involve the application of artificial intelligence. The scientific research projects are especially important for the cultivation of teachers and students, particularly the cultivation of specialized talents in applied technology. It is necessary to start with actual engineering projects. Schools continually increase the number of university student innovation and entrepreneurship projects to radiate all students in the school, even if teachers' scientific research projects can involve students in part. In implementation, various competitions and project implementations utilize knowledge in the direction of artificial intelligence and new technologies, establishing new models, adding big data processing, model establishment, algorithm use, etc., to traditional projects to complete secondary innovation, which is particularly important for the implementation of current large projects. Today, with the continuous development of technology, using 5G high-speed networks, and convenient platforms such as cloud computing, etc., we support projects related to artificial intelligence in university student innovation and entrepreneurship training projects and climbing technology plan projects. Based on projects, we enhance students' scientific research and practical abilities, stimulate students' innovative consciousness, and the implementation of projects greatly enhances students' engineering qualities, innovation capabilities, and collaborative problem-solving abilities. It is necessary to change the

previous way of students' independent enrolment, consciously guide students in the course, let students think about the application of knowledge in the direction of artificial intelligence to the project, relying on innovative projects to promote the development of artificial intelligence projects, and the organic combination of teaching, scientific research, and the project. It is better to start motivating students' innovation consciousness from the lower grades.

3.3. Strengthening the Organization of Large-scale Science and Technology Competitions

The "Internet+" College Students Innovation and Entrepreneurship Competition, as the most influential competition, has been running for 9 years, spawning a batch of outstanding enterprises and entrepreneurship projects of the era. The competition itself is a national service network for college students' entrepreneurship, where entrepreneurship investment and incubation can take place. For students majoring in electronic information, it is a trial ground for innovation and entrepreneurship training. There's also the industry proposition track, applying artificial intelligence technology to professional projects, which can better and optimally develop products in line with the characteristics of the era. It is necessary to intensify the promotion of the competition, encourage lower-grade students to prepare in advance, select excellent students and teams to use artificial intelligence-related technologies for innovative application development, and participate with technology-based projects. The annual "Challenge Cup" competition is also an excellent training platform, integrating competition into the students' learning life as part of the teaching, indicating that project design and implementation are carried out based on the knowledge reserve of cutting-edge artificial intelligence technology. Looking at the current professional projects, including the natural science projects applied for by professional teachers, all involve the application of big data and artificial intelligence technology. This provides a clear direction, increasing investment and support in this key area of competition, striving to achieve certain results, and achieving good teaching reform effects.

3.4. Cultivation of Innovative Teachers in Artificial Intelligence

Grounded in the context of the artificial intelligence (AI) era and proactively responding to national policies, lays the foundation for the design of innovative teacher education systems. Cultivating outstanding teachers for the future is a requirement set forth by the advancement of our times[2]. Enhancing the professional capabilities of AI course instructors and fostering innovative AI educators who can serve various specialties are of paramount importance. With the onset and widespread popularity of AI education, as well as the continuous development of AI technologies and applications, the demand for talent has been increasing annually, prompting transformative changes in many industries. The enthusiasm for setting up AI majors in universities has not diminished, ranging from 'Double First-Class' institutions to local undergraduate colleges, to higher vocational schools, all are eager to establish and actively build AI majors. However, it must be recognized that there is currently a general lack of robust faculty resources, and many specialized course instructors lack experience in teaching within the AI system. The positioning of different levels of higher education institutions is not clear, and simply setting relevant courses does not necessarily meet the requirements of their schools and students. Non-AI engineering majors face greater difficulties in cultivating AI teachers tailored to their disciplines, involving the application of AI in their specific fields. Therefore, higher requirements are imposed on course instructors, and the teaching issues in this direction cannot be resolved by simply adding a few courses. Enhancing the professional capabilities of AI course instructors is particularly important. Teachers should frequently participate in academic conferences, keep track of industry frontiers, and regularly participate in AI teacher training at the provincial level or above, continually improving their professional capabilities and technical levels.

3.5. Integrating Civic Education in Artificial Intelligence Courses

Teachers should conduct thorough research on the needs of relevant enterprises, reasonably formulate tiered training, teach students according to their aptitude at different levels, and adequately combine basic accumulation and practical operation. They should inspire students'

enthusiasm for learning and consider ideological and political education as an essential index of the construction. Teachers should subtly integrate ideological and political education and team collaboration spirits into the course construction at all times and strictly demand teachers and students from an ideological height. Ideological and political education should be reflected in every link of the course. When formulating a new teaching syllabus, they should design key points where ideological and political content can be inserted. They should propose ideological and political cases in the knowledge point section of project cases and algorithm teaching and guide and explain them. They should feedback the effect of students in ideological and political education and dynamically adjust its knowledge content. In the impact of artificial intelligence technology on the professional field, teachers should enhance the connotation and quality of ideological and political education.

3.6. Construction of the Artificial Intelligence Course System and Integration into the Professional Education System

A course system that suits the conditions of their own majors should be built, and a teaching case resource library that suits their own level should be constructed. In the direction of artificial intelligence, a corresponding course system should be established from low to high. Because artificial intelligence itself is an interdisciplinary subject, many courses overlap significantly with electronic information major courses. As long as corresponding artificial intelligence application technology elective courses are added, the requirements can be met. Many overlapping courses can add chapters of related knowledge points. The course setup can be driven by projects. Starting from lower grades, related courses such as innovative engineering training, Python language, and introduction to artificial intelligence are offered. Advanced courses include machine vision, machine learning, data analysis, computation, etc., not limited to the above course construction. You can also add relevant knowledge points of artificial intelligence in existing courses such as embedded and Internet of Things courses. At the end of the term, use the form of team projects and give students a limited range to complete the course design related to artificial intelligence. Many universities' artificial intelligence specialized courses are similar, and they are basically a step-by-step course system. They also lack teaching resources that suit their own situation. It is necessary to establish a teaching resource library that meets the application form of artificial intelligence technology. The fastest way to accumulate teaching resources is for the teachers to focus on superior resources and publish practical textbooks suitable for their own schools. The table below lists the experimental part of artificial intelligence application and technology for electronic information major.

Table 1 Artificial intelligence applications and technology experimental section.

Experimental project name	Experimental content and requirements	Lesson time	type	Number of students per group
Linear regression experiments	Use linear methods for house price prediction	3	Integrated	4
Decision Tree Experiment	Implement decision tree ID3 algorithm in Python	3	Integrated	4
Image segmentation experiment	Implement image segmentation using K-mean algorithm	3	Integrated	4
BP neural network experiment	Use BP neural network for data analysis	3	Integrated	4
Convolutional Neural Network Experiment	Use convolutional neural network to complete the classification experiment	3	Integrated	4
Reinforcement learning experiment	Introduce reinforcement learning methods to make the game pass	3	Integrated	4
Total		18		

3.7. The Impact of ChatGPT on Education in the Field of Artificial Intelligence

The rapid development and widespread adoption of ChatGPT will promote educational reform

and innovation[3]. As a successful large language model artificial intelligence product, its launch has undoubtedly accelerated the transformation brought about by artificial intelligence, affecting all aspects of social life and propelling educational reform. Students can quickly acquire the knowledge they need through applications and solve text problems through the platform. With the development of the model, there are more and more applications from text to images and videos, which greatly facilitates students' self-study. However, it should also be recognized that education in the direction of artificial intelligence cannot entirely depend on machines, which may bring some negative effects. Teachers should guide students to use the platform reasonably, especially to assist in completing learning in the direction of artificial intelligence. In the application of electronic information majors, teachers' reasonable design is still needed. Many knowledge-based machine answers are not the correct results. In short, on the one hand, ChatGPT's educational potential is immeasurable. On the other hand, it constitutes a complex relationship with education [4].

4. Conclusion

Artificial Intelligence (AI) is the fastest growing major in emerging engineering fields, emphasizing the imperative to advance these disciplines. It's vital to investigate the relationship between AI and electronic information disciplines, merge their knowledge systems, and identify key content. Education models, influenced by moral education, must be shaped to establish effective teaching methods for these new fields. The goal is to foster innovative spirit and adaptability to new concepts in students, encouraging them to harness AI for innovation and application within their disciplines. AI's role is pivotal in developing electronic products and fueling entrepreneurship. The task at hand is to nurture innovative talents capable of transforming traditional paradigms. Fundamentally, the educational system needs to be realigned to integrate AI into broader electronic information teaching methodologies.

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