Construction and Implementation of Specialized Courses on Artificial Intelligence Applications

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Abstract: This paper discusses the teaching objectives and contents, the implementation of teaching mode, methods, and the results of course construction of the course "Special Topic on Application of Artificial Intelligence," which is set up for students majoring in artificial intelligence in Northwest A&F University. The course aims to comprehensively improve students' vision, thinking and ability to solve professional complex problems by using artificial intelligence technology. The course covers the application of artificial intelligence technology, such as generative artificial intelligence, multi-objective reinforcement learning, and multi-modal machine learning in marketing, power grid, medical, and agricultural industries. The teaching of the course mainly adopts the mode of online and offline mixing, the integration of science and practice, and the cooperation of school and enterprise, and combines the methods of special report, exchange and discussion, and project report. The teaching feedback shows that students generally hold a positive attitude towards the course content, teaching mode and method, which provides useful reference for the construction and practice of the course in other universities and majors.

Keywords: Artificial intelligence; Application topic; Mix online and offline; Physical integration; School-enterprise alliance

1. Introduction

In today's digital age, the rapid development of artificial intelligence technology is profoundly changing the operation of various industries and promoting social transformation and innovation. Various industries and fields are also increasingly relying on the application of artificial intelligence technology, from traditional manufacturing to modern services, all of which benefit from the efficiency and intelligence it brings [1,2]. Therefore, it is of great significance to build an artificial intelligence minor in higher education. With the advancement of intelligence and digitalization in all walks of life, students in colleges and universities need to have interdisciplinary abilities, not only to master the core knowledge of their major but also to be proficient in artificial intelligence technology to better cope with future challenges [3,4].

To meet this demand, Northwest A&F University has set up the course "Special Topics on Artificial Intelligence Application" especially for students majoring in artificial intelligence. The course is designed to reflect a deep understanding of current educational needs, emphasizing the importance of developing students' ability to use AI to solve complex application problems in their majors. By adopting a variety of teaching modes and methods, the course aims to provide students with a rich learning experience that enables them to apply AI technology in practical applications. This teaching reform and practical exploration not only provides a new idea for the construction of applied thematic courses in Northwest A&F University but also provides a beneficial reference for the curriculum development of other universities in the field of artificial intelligence.

2. Course teaching objective and content setting

2.1. Course teaching objectives

Taking into account the nature and orientation of the course, characteristics of minor students, intelligent development needs of various industries, existing teaching resources and conditions and other factors [5-7], the teaching objectives of Artificial Intelligence Special Course are summarized into three dimensions: Knowledge, ability and quality, and the specific requirements of each dimension are shown in **Table 1**.

Table 1. Course teaching objectives

Dimensions	Specific teaching objectives
Knowledge dimension	To understand the evolution path of artificial intelligence technology and the far-reaching impact of its application on the development of various industries; To understand the basic principles of AI-related technologies, such as generative AI, multi-objective reinforcement learning, and multi-modal machine learning; To understand the specific application cases of common AI technologies in marketing, agriculture, healthcare, life science, food science, and other fields to expand their knowledge horizons;
Competency dimension	The ability to independently plan, implement, and present simple AI projects; The ability to work in teams across disciplines to meet the needs and challenges of future interdisciplinary collaborations;
Quality dimension	Moral and social responsibility when applying artificial intelligence to solve practical problems; Possess critical thinking and continuous learning attitude to promote self-growth in the field of artificial intelligence; Teamwork spirit and interdisciplinary thinking to promote communication and cooperation between different fields.

2.2. Course teaching content

By the principle of attaching equal importance to theoretical knowledge and applied practice, the teaching content mainly includes two parts: Theoretical teaching and practical teaching. The specific settings are shown in **Table 2**. Among them, the theoretical teaching consists of a special report on the application of specific research problems in the fields of AI-enabled commerce, agriculture, medicine, electricity, food science and life science, etc. The practical teaching part is for students to choose a topic freely according to their major direction and complete simple AI project development or application summary tasks under the guidance of teachers.

Table 2. Course teaching content

Theoretical teaching content		Practical teaching content	
AI enabling industry	**Topic title**	**Major**	**Sample topic selection**
AI+ agriculture	Smart agricultural Internet of things and its application	Electromechanical	Agent control code generation and application based on LLM
AI+ marketing	AIGC empowers multi-modal marketing content creation	Wine	Identification of grape varieties based on deep learning
AI+ medicine	Multi-modal neuroimage-driven disease diagnosis	Electromechanical	UAV path planning based on reinforcement learning
AI+ power	Grid chain fault prevention and control based on multi-objective reinforcement learning	Dynamic medicine	CNN-based brain CT image recognition of infected Toxoplasma gondii
AI+ life	AI empowers disease target prediction and drug retargeting	Plant protection	Application of deep learning to soil and plant nutrient determination
AI+ food	AI enables quality evaluation and authenticity identification of agricultural and sideline products	Agriculture	Design of disease and pest monitoring system for kiwi fruit orchard based on open space multi-source information
AI+ mathematics	Swarm intelligence optimization algorithms and their applications	Soil	Research on the properties of geochemical rare earth elements and their application to materials based on their learning
Other	…	other	…

3. Selection and implementation of teaching mode and method

3.1. Selection and implementation of teaching mode

Considering the particularity of the student group of minor majors and the difference between the teaching content of the school and the actual development of the enterprise, in addition to the teaching mode combining theory and practice, the curriculum group also adopts the mode of online and offline mixed teaching and school-enterprise joint teaching [8]. In the concrete implementation, the offline classroom teaching combined with the online teaching of Tencent conference is adopted, and the cloud recording and broadcasting function of Tencent conference is also launched. For students who cannot participate in offline classroom teaching or cannot guarantee online participation in time, the course team will record and broadcast all the video resources on the super star learning channel, which is convenient for students to learn flexibly according to their own time, but also for some of the teaching content did not understand the students to create conditions for re-learning. In addition, another advantage of this mode is that with the continuous enrichment of thematic content, this mode will help accumulate more teaching resources and provide more space for students to freely choose topics.

3.2. Selection and implementation of teaching methods

Considering the particularity of the application of thematic courses [9,10], the teaching group mainly chooses three teaching methods: Thematic report, exchange discussion, and project practice. The specific implementation requirements and advantages of each method are analyzed as follows:

(1) Special report type: Special report type teaching is conducted by teachers in different fields who are deeply engaged in artificial intelligence application research for specific problems. The content of the special report includes five parts: Background of the research problem and research significance,

principles of artificial intelligence technology, research ideas and methods, analysis and discussion of experimental results, summary and prospect. Through the special report, students can understand the evolution path of artificial intelligence technology and the important impact on the development of the industry and society, understand the basic principles of common artificial intelligence technology, understand the specific application of artificial intelligence technology in various industries, and experience the moral and social responsibility when artificial intelligence solves practical problems.

(2) Exchange discussion: At the end of each special report [11], there is a certain time to carry out exchange and discussion activities. The theme of the discussion mainly includes two aspects: a) Thinking about the possible shortcomings of the current method and what aspects can be further optimized in the future? b) In conjunction with major thinking, what problems can the techniques used in the topic be used to solve for the major? The former discussion topic aims to better inspire students' critical thinking, while the latter aims to better inspire students' multidisciplinary thinking. Through discussion, students can share ideas, solve problems, and learn from each other's experiences.

(3) Project practice: Students can choose topics freely according to their major direction, develop projects independently or cooperatively, and complete the development of simple artificial intelligence projects under the guidance of teachers [12,13]. The teacher will analyze the feasibility of data acquisition, experimental conditions, and experimental methods and supervise and guide the project development process. Through the project practice, the students become familiar with the project development process and have the ability to work in a team.

4. Practical course construction

According to the teaching objectives of the course "Application of Artificial Intelligence" for artificial intelligence minor and major, the training of students should focus on mastering the basic principles of artificial intelligence technology, improving the application ability of artificial intelligence technology, and cultivating artificial intelligence literacy. The course has received funding from the Ministry of Education's Industry-university-research Collaborative Education Project and the university-level teaching reform project of Northwest A&F University and the College of Information Engineering. Since its independence, the main achievements have been as follows: a) 10 application topics of artificial intelligence technology applied in marketing, power grid, medical treatment, agriculture and other industries have been built; b) A teaching team composed of 10 young teachers has been established, and the topics are all taught by teachers who are deeply engaged in AI application research in different fields and face specific problems, including nine who have a doctor's degree, one enterprise tutor and two senior professional titles; c) It has accumulated a rich library of online teaching resources, including 30 online special report videos, 14 courseware resources, and 13 theoretical and practical teaching plans [14,15].

The teaching feedback indicates that students hold a positive attitude towards the design and teaching methods of the course "Special Topic on Artificial Intelligence Application." They generally believe that the course content covers a wide range and cutting-edge, involving the application of AI technologies such as AIGC, multi-objective reinforcement learning, and multi-modal machine learning in various industries such as marketing, power grid, medical care, and agriculture, which helps to expand their knowledge horizon. The teaching methods of thematic report, exchange discussion, and project practice were recognized by the students,

who believed that these methods promoted the combination of theory and practice, deepened the understanding of the course content and the reflection on the major problems. At the same time, students also put forward suggestions, including adding more technical application thematic resources. Based on these feedbacks, the content structure of the course will be optimized, teachers' teaching ability will be improved, and the construction of thematic resource libraries will be enriched to better meet students' personalized professional learning needs and improve teaching quality.

5. Conclusion

This paper discusses the teaching goal, content, mode, and method of the course "Artificial Intelligence Application Topic" set up by Northwest A&F University, as well as the actual effect of course construction. The course has greatly expanded the original thematic content, covering more artificial intelligence technology and practical applications in the industry. The teaching mode combining online and offline makes the class time of minor majors more flexible, and the school-enterprise joint mode improves students' career competitiveness and practical operation ability, making the course closer to the market demand and industry development trend. The teaching methods have become more diversified, and the new communication and discussion method helps to further improve students' critical thinking and interdisciplinary integration thinking. The project's practical teaching combines theoretical learning with applied practice, and cultivates students' ability of project development and interdisciplinary cooperation.

Looking forward to the future, it is possible to further expand the application field of the course and increase the coverage of emerging technologies, such as edge computing and intelligent games, to cope with the changes in technological development and the expansion of application fields. To sum up, the successful experience of the course "Artificial Intelligence Application Topics" provides a useful reference for other higher education institutions in the design and implementation of artificial intelligence minor courses, and also lays a solid foundation for the further exploration and innovation of Northwest A&F University in the field of applied talent training.

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The authors declare no conflict of interest.

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