Research on Online and Offline Hybrid Teaching of Introduction to Artificial Intelligence

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Abstract. In view of the current teaching situation and challenges faced by the Introduction to Artificial Intelligence course, this paper analyzes the core teaching objectives of the course, and explores the online and offline hybrid teaching methods of it. This paper analyzes the advantages of online and offline hybrid teaching, and probes into the development mode of online and offline hybrid teaching of Introduction to Artificial Intelligence from the aspects of teaching content, teaching mode, teaching effect, examination method, etc.

Keywords: Introduction to Artificial Intelligence; online and offline hybrid teaching; teaching reform.

1. Introduction

With the significant progress made in Artificial Intelligence (AI) technology, there has been a worldwide AI boom, which not only involves scientific research institutions, academia, industry, but also has risen to the height of national strategy, and has had a huge impact on the field of education. In 2017, the State Council issued the Development Plan for a New Generation of Artificial Intelligence [1]. In 2018, the Ministry of Education issued the Action Plan for Artificial Intelligence Innovation in Colleges and Universities [2]. Under the guidance of national policies and guidelines, domestic universities have begun to build AI majors, colleges, research institutes and research and education platforms. To actively respond to the development strategy of the AI industry, Wuhan University set up the AI specialty and carried out various teaching and research work on the construction of the AI specialty [3]. As a basic course of AI specialty, Introduction to Artificial Intelligence is a key basic course for students to understand the development history, basic theories and methods, research frontiers and development trends of AI discipline. The course is highly comprehensive and involves a wide range of knowledge. At the same time, it needs to lay a solid theoretical and practical foundation for other advanced AI courses. Therefore, the teaching objectives, concepts, content, resources and methods need to be optimized and adjusted to meet the learning needs of AI students. This work mainly discusses how to introduce online and offline hybrid teaching methods into the course Introduction to Artificial Intelligence to stimulate students' interest and initiative in learning, so as to achieve the goal of improving teaching quality and learning effect.

2. Current Situation and Existing Problems

Artificial Intelligence is a frontier discipline of computer science, and it is also a comprehensive cross discipline. It mainly studies imitation and extension of human intelligence by employing computer technologies, so as to achieve machine intelligence. The course of Introduction to Artificial Intelligence is a professional basic course for the major of artificial intelligence. It is offered as a compulsory course for students majoring in artificial intelligence in the first semester of their sophomore year. Its purpose is to enable students to preliminarily understand the basic principles of artificial intelligence, preliminarily learn and master the basic skills of artificial intelligence, so as to broaden their knowledge and further learn advanced courses of artificial intelligence, such as Machine Learning, Computer Vision, Natural Language Processing, Intelligent Computing System, Knowledge Engineering, etc.

According to the requirements of the syllabus of Introduction to Artificial Intelligence, the course needs to help the students achieve the following teaching objectives: (1) Understand the framework of the AI knowledge system, systematically master the basic principles and strategies of Search Based Problem Solving, Knowledge Representation and Reasoning, Machine Learning, etc., and improve the ability to understand and solve AI problems using relevant technologies; (2) Understand the modeling methods for artificial intelligence problems, and master the design ideas, technical solutions and results analysis of complex engineering problems; (3) Understand the development and principle of the new generation of AI technology, have a holistic understanding of the frontier and trend of AI, be able to refine problems, have some professional insights on the future development of technology, and be able to communicate and exchange AI issues in a cross-cultural and cross professional context.

What is incompatible with the increasing teaching requirements of Introduction to Artificial Intelligence course is that the current teaching is mainly based on the traditional teaching mode. Teaching is carried out around three centers, namely, the teaching process is teacher centered, the teaching scene is classroom centered, and the teaching resources are textbook centered. The teaching method is mainly teaching and questioning, and the students are passive learning. The teaching method is relatively simple. Although the practice and communication ability of students have been increased in the form of experimental work and team cooperation during the course, the teaching content of this part only plays an auxiliary role, and there are still deficiencies in the cultivation of students' ability to knowledge application, innovation, practical operation and communication, The teaching goal of Introduction to Artificial Intelligence cannot be fully realized. At the same time, in the Internet era, students have rich and diversified sources of knowledge. If teachers only teach theoretical knowledge on books in the classroom, it is difficult to stimulate students' learning motivation and interest, which leads to reduced classroom learning efficiency. It is difficult to fully stimulate students' interest in learning and strengthen the cultivation of students' practical ability and communication ability by the existing face-to-face teaching method. Therefore, in order to achieve the teaching goal with higher requirements, the Introduction to Artificial Intelligence course needs to use more advanced teaching models and more powerful teaching support tools.

3. Online and Offline Hybrid Teaching

Online and offline hybrid teaching mode is a hybrid teaching mode that combines online teaching with traditional offline classroom teaching, which can make full use of both advantages and effectively overcome their respective shortcomings. In recent years, due to the excellent performance of the mixed teaching mode in improving the teaching effect, it has been widely concerned and applied to the teaching reform of various disciplines and specialties [3-6]. The advantages and disadvantages of online teaching and offline teaching are compared as shown in the table 1.

Table 1. Online and offline teaching comparing

Teaching mode	Advantages	Disadvantages
Online	(1) The output of course teaching is stable. Because of the use of pre-recorded courses, the organization of teaching content can ensure the preciseness and scientific consistency of the curriculum through repeated and strict design and arrangement. Learning effect is not affected by the subjective state of the teachers, so as to ensure the integrity of knowledge	(1) Too much reliance on students' learning consciousness.

		transmission.
	(2) The available resources enrich the variety of display forms, so that teachers can make full use of various pictures, animation, video demonstration and other technologies to display the knowledge they need to teach more vividly.	(2) When students have questions about the content they have learned, they can not get answers through communication with teachers in a timely manner.
	(3) Personalized learning. Due to different abilities and interests of students, each student has different needs for learning. Online teaching can be used by students to choose the content of learning and arrange the learning progress according to their own abilities.	(3) Lack of learning atmosphere under the collective learning environment,
Offline	(1) The collective learning environment is convenient for tistudents to communicate with each other, find their own shortcomings through the problems of other students, and find and fill the gaps through joint learning.	(1) Unable to personalize learning.
	(2) Direct communication with teachers enables students to bring out questions and solve doubts in a timely manner, so as to avoid reducing learning interest due to unanswerable questions.	(2) Classroom learning must be conducted at a fixed time and place;
	(3) Under the guidance of teachers, we can learn more efficiently and avoid time-wasting in ineffective learning.	(3) There is a certain randomness in teachers' teaching. Under the framework of the syllabus, each teacher's teaching focus, selected interpretation methods, selected exercises or other teaching resources have a certain degree of personalization, which makes different classes have certain differences in learning and uneven teaching quality.

Through comparative analysis of the advantages and disadvantages of online and offline teaching, we believe that if the two teaching methods can be effectively combined to form complementary advantages and overcome their shortcomings, the teaching level and quality can be improved to a greater extent.

4. Reform of online and offline hybrid teaching of Introduction to Artificial Intelligence

Adopting the online and offline hybrid teaching mode in Introduction to Artificial Intelligence requires an all-round reform of the course, including the design of the whole course teaching scheme, the selection of textbooks and reference materials, the design and recording of MOOC, the integration and management of teaching resources, the organization of the online teaching platform, the design of the course evaluation scheme, and so on.

4.1 Course Design of Introduction to Artificial Intelligence

The curriculum design can be divided into online and offline parts. However, the teaching of these two parts is not separated from each other, but needs to cooperate with each other to learn from each other to complement each other's strengths. The specific design ideas are as follows.

4.1.1 Online Course Design

The online teaching content to be designed for Introduction to Artificial Intelligence includes: course admiration, online teacher-student interaction and communication scheme, online homework, experiment and test scheme, other online learning resource organization scheme, etc.

(1) Course MOOC: According to the course syllabus of Introduction to Artificial Intelligence, the MOOC is made according to the four themes of "The Past, Present and Future of Artificial Intelligence", "Search Based Artificial Intelligence", "Knowledge Representation and Reasoning", and "Machine Learning and Neural Network" to ensure the standardized teaching of the basic tasks of course learning.

(2) Communication and interaction between teachers and students: online communication plan needs to include real-time and non-real time interaction. Among them, real-time interaction adopts personalized guidance for course learning, and provides direct communication channels between teachers and students with QQ, WeChat and other instant messaging tools. Through online reservation function, students can book one-to-one online Q&A time with teachers, and conduct online personalized guidance and Q&A at specific time periods. Non-real time interaction is conducted through online discussion area and e-mail. The MOOC platform provides online discussion area for courses. In the discussion area, teachers and students can put forward discussion questions. Students studying the course and all teachers in the course group can participate in the discussion. The students also submit questions to the teachers through the e-mail system, and the teachers answer questions in non-real time through e-mail.

(3) Homework, experiment and test: The course team will establish a question bank on the MOOC platform, uniformly release the homework online according to the teaching plan, and students will submit the homework through the platform. The content of the homework mainly includes the practice and examination of basic theories, methods and algorithm processes. After the completion of each theme teaching task, students need to conduct an online test. Each student randomly selects questions from the question bank to form a test paper for staged tests. The online test is completed by students at any time within a certain time range (such as one week). The MOOC platform provides a question bank for students to practice independently after class (the repetition rate of the questions in the exercise question bank and the test question bank shall not exceed 20%). In addition to theoretical learning, the course also needs to cultivate students' hands-on ability. The course team sets up a course experiment homework library on the CG Experimental Platform. During each project study, teachers release small experiments corresponding to knowledge points through the platform, and students complete small experiment tasks and submit experimental codes and experimental reports to the platform (development language is not limited).

(4) Expanding teaching resources: The MOOC platform provides links to the network resources needed for course learning for students' extracurricular autonomous learning.

4.1.2 Offline Course Design

The offline course content includes: centralized explanation of key and difficult knowledge of the course, classroom discussion and question answering, presentation and defense of the results of the comprehensive practice project of the course, etc.

(1) Focused explanation of key and difficult knowledge: with four topics as the core, through the analysis and summary of students' online learning, question answering, homework and assessment, determine the difficult points of each topic, and carry out in combination with the key content of the course theme. Each topic is set with three class hours of key and difficult explanations for classroom teaching, focus on the important knowledge points of the topic and the outstanding difficulties encountered by students in the process of learning the topic, and carry out in-depth and detailed development to achieve the goal of "learning deeply and thoroughly" for the important knowledge points.

(2) Classroom discussion and question answering: Classroom discussion is carried out around four topics. This link is different from the explanation of key and difficult points. Students are encouraged to carry out self-questioning and self-answering active learning. Before class, students' questions about this topic are collected. Teachers collect and sort out the questions to form a list of topic questions, which are published to the discussion area of the course. Students who can answer relevant questions claim the questions from the list of questions before class and are ready to answer them, During the class discussion, the students will answer the questions on the spot, and other students can discuss the questions at the discussion time after the answers are given by the main students. One class discussion is set for each topic, which lasts for 3 class hours, and is carried out before the explanation of the key and difficult points in the corresponding topic class. Students are encouraged to solve their own questions through active learning, so as to cultivate their autonomous learning ability.

(3) The presentation and defense of the results of the comprehensive practice project of the course: around the three themes of "Search Based Artificial Intelligence", "Knowledge Representation and Reasoning", and "Machine Learning and Neural Network", teachers will publish comprehensive practice topics of the course, with no less than 4 optional practice topics for each theme, and 2-3 students will form a project team. Students will sign up for topics from the project topics published by teachers. Small class teaching will be adopted, with no more than 36 students in each class. Each teaching class is composed of 12 project teams and 4 practice projects for each theme. According to the learning order of the theme, the project achievements will be displayed and defended. The duration of each team's demonstration and defense is 1 class hour, including 15 minutes of achievements PPT demonstration and system demonstration, 15 minutes of questions and answers, and 15 minutes of teachers' comments. This link mainly trains students' ability to analyze and solve problems, practice and practice, teamwork, language expression and other comprehensive abilities.

4.2 Teaching Implementation of Introduction to Artificial Intelligence

The online and offline hybrid teaching is different from the traditional teaching method, which puts forward higher requirements for the curriculum team and teachers. It requires the curriculum team and teachers to make full preparations before class and guide students to promote the learning process according to the teaching plan in the course teaching process.

The preparation before class mainly includes the recording of MOOC, the construction and updating of the exercise bank and test question bank, the design and maintenance of the teaching theme small experiment, the design and maintenance of the practice of each theme project, and the updating and maintenance of the teaching reference materials. During the course teaching, the teacher should guide students to carry out pre-class learning, classroom learning and post class consolidation, and pay attention to controlling the effective progress of the teaching process. The implementation process of course teaching is shown in the following table.

Table 1. Three Scheme comparing

Content	Schedule	Teaching Method	Student's Task	Notes for Teachers
Introduction to the course	1st week	Classroom Teaching (2 class hours)	Be familiar with learning and experimental platform; prepare materials required for course learning.	Complete the preparation before class.
Topic 1: The past, present and future of artificial intelligence	2nd week	MOOC	Complete MOOC learning, exercise and subject quiz on MOOC Platform	Timely summarize students' learning, practice and testing
		Online Q&A	Reserve online comunication time (one-to-one), or ask questions through platform	Arrange the time for communication in advance for students to

			discussion area and email.	choose, and give feedback in time in the discussion area or by email
		Classroom Discussion (3 class hours)	Choose an interesting AI method and technology to introduce	Students can be designated or registered independently; guide the class to full discussion
	3rd week	Classroom explanation of Key and Difficult Points (3 class hours)	Participate in classroom learning	Key point: research status and frontier of artificial intelligence. Supplementary: summarize the learning situation of students, giving learning guidance
Topic 2: Search Based Artificial Intelligence Topic 3: Knowledge Representation and Reasoning Topic 4: Machine Learning and Neural Network" 2	4th week (Topic 2) 6th week (Topic 3) 8th week (Topic 4)	MOOC	Complete MOOC learning, exercise and subject quiz on MOOC Platform	Timely summarize students' learning, practice and testing
		Online Q&A	Reserve online comunication time (one-to-one), or ask questions through platform discussion area and email.	Arrange the time for communication in advance for students to choose, and give feedback in time in the discussion area or by email
		Classroom Discussion (3 class hours)	Claim and prepare problems before class, share their point of view in class, and participate in problem discussions	Summarize problems, issue lists of the problems, and organize class discussions
	5th week (Topic 2) 7th week (Topic 3) 9th week (Topic 4)	MOOC	2nd topic test	Summarize 2nd test in time
		Topic experiment	Select an experiment task for this topic and submit it on the CG experimental platform	Summarize experiment completion in time
		Online Q&A	Reserve online comunication time (one-to-one), or ask questions through platform discussion area and email.	Arrange the time for communication in advance for students to choose, and give feedback in time in the discussion area or by email
		Classroom Discussion (3 class hours)	Participate in classroom learning	Pay attention to the difficulties that students encounter and prepare the classroom explanation in combination with the important knowledge points of the subject.
		Topic project	Group and select sub-problems (4 groups)	Publish sub-problems on related topics
Theme Project Practice Results Display	10th week 11th week 12th week	Classroom presentation (4 class hours)	Group presentations, Q&A, project evaluations	Instruct students to complete PPT presentations; class reviews
Course	13th week	Classroom	Participate in classroom	Summarize the term and

Summary		Teaching (2 class hours)	learning and discussion	prepare for class discussions

4.3 Evaluation System for Introduction to Artificial Intelligence

The evaluation system of the course is determined by the teaching mode of the course. This course uses a online and offline hybrid teaching mode. The assessment of the course is also composed of two parts, online and offline. The assessment and evaluation of online learning consists of five parts, namely, curriculum learning evaluation (5%), homework completion evaluation (10%), online quiz evaluation (15%), online small experiment evaluation (15%), and online discussion evaluation (5%), which account for 50% of the total results. The evaluation of offline learning consists of three parts: the assessment of classroom participation (5%), the assessment of classroom discussion (15%), and the evaluation of project practice results (30%), which account for 50% of the total results.

Among them, because the project practice results are carried out in a group, it is necessary to make clear the contributions of the group members when presenting them. The evaluation of this part consists of two parts: the result evaluation and the individual contribution evaluation. For students with excellent online and classroom discussions, a maximum of 50% can be given for each item. For example, 5 points can be given for online discussions, and 7.5 points can be given for students with excellent online discussions.

5. Summary

The reform of teaching mode in universities has adapted to the needs of the times. Internet technologies have provided rich and diverse teaching resources for the computer specialty courses, and have realized the integration of online and offline teaching reform. In the process of implementing the innovative teaching mode of the course Introduction to Artificial Intelligence, the teaching goal of the course is always carried through the course design, embodying the student-centered educational idea, emphasizing on theoretical learning and practical ability.

The hybrid teaching mode is still in its early stage of development and needs to be improved continuously. There are still many deficiencies in hybrid teaching mode, including insufficient course resources, inadequate combination of online and offline teaching, imperfect learning platform, insufficient learning motivation of students, and untimely interaction between teachers and students. In the process of teaching, the teachers should adjust the teaching plan according to the actual situation of students, receive teaching feedback through various channels and make appropriate corrections.

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