Curriculum Reform and Practice of the Interdisciplinary Integration of Meteorology and Information Science

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Abstract: This paper discussed the curriculum construction and exploration of the intersection of meteorology and information science. The current situation and challenges of curriculum construction are analyzed, covering the integration and compatibility of traditional atmospheric science in interdisciplinary fields, and how to promote the improvement of teachers teaching quality. This paper puts forward the development concept of interprofessional curriculum construction, the optimal combination of meteorological courses, and the reform of interdisciplinary talent training mode. In addition, specific measures to promote the construction of meteorological informatization in colleges and universities are also discussed, including the construction of characteristic talent training program, the establishment of comprehensive curriculum system, and strengthening the training of teachers scientific knowledge. This paper aims to cultivate interdisciplinary talents with interdisciplinary knowledge and skills, and then promote the coordinated development of meteorology and information science majors.

Keywords: Meteorological and information science; Cross Integration curriculum; Interdisciplinary talents; Curriculum reform

1. Introduction

The intersection of meteorology and information science is of great significance in the current era[1]. With the rapid development of science and technology, the meteorological field has put forward higher requirements for the accuracy, timeliness and analysis ability of data[2]. The continuous progress of information science, such as big data, artificial intelligence, cloud computing and other technologies, has provided a strong support for the development of meteorological science[3]. In the current curriculum construction, the traditional meteorological curriculum often focuses on meteorological theory and observation technology, while the integration of information science is relatively insufficient. However, with the continuous expansion and deepening of meteorological business, the demand for talents with the cross knowledge of meteorological and information science is increasing.

The existing disciplines of meteorology and information science still have significant professional barriers, and the integration of different technologies in teaching focuses more on theoretical knowledge. However, there are still significant difficulties in practical operation, such as the insufficient level of informationization in numerical forecasting and the adoption of different technologies for meteorological information integration[4]. This has created difficulties in the process of cultivating students, as single theoretical or practical teaching cannot effectively cultivate comprehensive abilities. Therefore, a combination of theoretical lectures and practical courses is adopted in the construction of the curriculum. The exploration and practice of the reform of meteorological information interdisciplinary curriculum is helpful to cultivate interdisciplinary talents with interdisciplinary knowledge and skills, improve the accuracy and timeliness of meteorological services, and promote the coordinated development of meteorological science and information science[5]. Information technology, such as big data and artificial intelligence can provide powerful tools and methods for meteorological science. Through the construction of cross-integration courses, students can not only master solid

meteorological theory knowledge, but also have advanced information science skills, to meet the needs of the society for compound talents. The development of information science provides a more efficient means for the collection, transmission, processing and analysis of meteorological data. The interdisciplinary integration of meteorology and information science not only helps to improve the development level of meteorology, but also expands new fields for the application of information science[6]. Through the curriculum construction, it can promote the exchange and cooperation between the two disciplines, jointly overcome technical problems, and promote scientific and technological innovation.

2. Challenges Facing the Construction of Interdisciplinary Courses of Meteorology in Colleges and Universities

2.1 The Informatization Level of Traditional Atmospheric Science is not High

The core of meteorology lies in meteorological observation, and information technology plays an indispensable role in this process. Take meteorological observation equipment as an example, modern observation tools such as meteorological satellites, meteorological radar and meteorological sounding instruments all rely on the support of information technology. Numerical forecasting is a major method of weather forecasting, by establishing mathematical models to simulate atmospheric movement and changes to predict future weather conditions[7]. This method uses computers to process large amounts of data to provide a scientific basis for weather forecasting. However, the accuracy of the numerical models is affected by many factors, including the error of the initial conditions, the accuracy of the model assumptions, and the topography. May lead to errors in the model in the long-term prediction. In order to reduce the prediction error, the scientists adopted the method of set prediction, which is running multiple different initial conditions or model parameters simultaneously[8]. However, the application of artificial intelligence and machine learning technology to the future weather prediction is still less, and the level is not high

2.2 Difficulties in the Cross-Integration of Meteorology and Information Technology

In the field of meteorology, information science has shown great advantages in the data processing and analysis of atmospheric science majors. Through big data, artificial intelligence, machine deep learning and other advanced technologies, we will constantly dig deep into meteorological data to improve the accuracy of weather forecast. Using AI and machine deep learning technology to conduct in-depth research of meteorological data can provide short-time forecast accurate to kilometer level and minute level, among which the accuracy of short-time forecast is more than 90%, far ahead of the industry level. However, there are problems in the cross-integration of information science and traditional atmospheric science. For example, in numerical prediction, how information science and technology provides strong support for the construction of mathematical models is challenging[9]. Numerical prediction is based on complex mathematical equations. These equations are transformed into computer processing forms, and the construction of mathematical models requires a lot of information technology, and there are a lot of technical problems.

2.3 The Scientific Literacy of the Teaching Teachers Needs to be Improved

As the impartor of the curriculum, their scientific literacy plays a vital role in the teaching quality. In the course of meteorology and information science, teachers not only need to have solid professional knowledge of meteorology, but also need to master advanced information science and technology, so as to organically combine the two disciplines for teaching. Therefore, it is necessary to understand the application scenarios and development trends of technologies represented by big data, cloud computing, Internet of Things, 5G and artificial intelligence in the field of meteorology. The lack of scientific literacy of teachers, including the lack of professional training and academic exchange activities, leads to the failure of teachers to understand the latest research results and teaching methods of the cross-integration of meteorology and information science. Secondly, the lack of scientific research projects may also lead to the low

quality of teaching.

3. Specific Measures to Promote the Construction of Meteorological Information in Colleges and Universities

3.1 Change the Concept of the Construction and Development of Meteorological Major Courses

At present, the interdisciplinary curriculum of meteorology and information science in colleges and universities is gradually enriched. On the one hand, it retains the core courses of traditional meteorological majors, such as atmospheric physics, principles of weather science, climatology, etc., which have laid a solid theoretical foundation of meteorology for students. On the other hand, more courses related to information science have been added, such as data structure and algorithms, database principles, machine learning, etc. Through these courses, students can systematically learn meteorological knowledge and information science and technology to prepare them for their future work in the intersection of meteorology and information science. Traditional meteorological professional courses focus on the teaching of theoretical knowledge and the analysis of meteorological phenomena, so as to cultivate students understanding and prediction ability of atmospheric movement and weather changes[10]. The information science related courses emphasize the cultivation of data processing, algorithm design and model building skills, so that students have the ability to use information technology to solve meteorological problems.

Changing teaching methods and means, teaching methods lead to low participation of students and lack of practical ability. In order to make up for the deficiency of didactic teaching, case teaching and practical teaching are also widely used. The case teaching guides students to analyze and solve problems through the practical meteorological and information science cross cases, and improves students practical ability and innovative thinking[11]. In terms of teaching means, multimedia teaching displays the teaching content through various forms such as pictures and videos, so as to make the teaching more vivid and improve students interest in learning. The online teaching platform provides students with rich learning resources and opportunities for interactive communication, which is convenient for students to study anytime and anywhere.

3.2 Realize the Optimization and Combination of Meteorological Major Courses

In terms of curriculum setting, the curriculum system of "meteorology + information science" has been constructed. In addition to the traditional meteorological professional courses, there are also a series of information science related courses, such as "meteorological data mining" and "meteorological information visualization". These courses closely combine meteorological data with information science and technology to cultivate students ability in data processing and analysis. In terms of teaching methods, we adopt diversified teaching methods and pay attention to the combination of theoretical teaching and practical teaching. For example, in the course of "Meteorological Information System Development", students should not only learn the theoretical knowledge of the information system, but also master the skills of system design, development and maintenance through practical project development. In addition, actively carry out case teaching and group discussion. Guided by the case of actual cases of meteorology and information science, the teacher organizes students to analyze and discuss, so as to cultivate students problem-solving ability and team spirit.

3.3 Promote the Reform of the Cross-Sectional Talent Training Mode

The interdisciplinary integration of meteorology and information science requires the cultivation of interdisciplinary talents with interdisciplinary knowledge and skills. With the continuous expansion and deepening of meteorological business, the demand for such talents is increasing. Cross-cutting talents can better deal with complex meteorological problems, and use information science and technology to improve the accuracy and timeliness of meteorological services. Through the optimization of curriculum system, strengthening practical teaching, building tutor team and promoting academic exchanges, jointly promote the reform of cross talent training mode. details are as follows:

(1) Optimization of curriculum system: to further improve the curriculum system of meteorology and information science, and increase the proportion of interdisciplinary courses. In addition to the existing courses such as meteorological big data analysis and meteorological artificial intelligence, courses such as meteorological information security and meteorological software engineering can be offered to broaden students knowledge. At the same time, the correlation between courses should be strengthened, and comprehensive course projects should be set up, so that students can integrate the knowledge and skills of different disciplines in practice.

(2) Strengthening practical teaching: strengthen the intensity of practical teaching, and establish more practice bases with meteorological departments and information technology enterprises. Students can be exposed to the actual meteorological business and information science application scenarios during the practice to improve their ability to solve practical problems. For example, working with the China Meteorological Administration to allow students to participate in meteorological data processing, weather forecast model optimization and other work.

(3) Mentor team building: Establish a mentor team composed of experts in the field of meteorology and information science. Tutors can jointly guide students study and research, and provide students with interdisciplinary guidance and advice. For example, when students conduct meteorological data mining projects, meteorological tutors can provide expertise in meteorological data, and information science tutors can guide the selection and application of data mining algorithms.

(4) Academic exchange promotion: hold academic lectures, seminars and other activities in the interdisciplinary field of meteorology and information science to encourage students to participate actively. Students can communicate with domestic and foreign experts and scholars to understand the latest research trends and cutting-edge technologies, and broaden their academic horizons.

4. Specific Measures to Promote the Construction of Meteorological Information in Colleges and Universities

4.1 Construct a Characteristic Meteorological Information Cross-Integration Talent Training Program

Through the integration of basic theories and the introduction of practical cases to achieve interdisciplinary training. The integration of the basic theories of meteorology and information science is the key to build a characteristic talent training program. Theories of atmospheric physics and weather science principles in meteorology and data structure and algorithms in information science can be integrated in various ways. For example, when explaining the radiative process in atmospheric physics, the data modeling method in information science can be introduced to mathematically model the radiative process to better understand and analyze. At the same time, in the data structure course of information science, the characteristics of meteorological data can be combined with their characteristics, such as spatial and temporal data structure design, and multi-source heterogeneity. Introduce practical cases is an important means to enhance the practicability of the course. Practical cases can be introduced from meteorological forecast, meteorological disaster early warning and meteorological data processing. For example, when explaining meteorological data processing, relevant data processing cases can be introduced. Let students better understand the application of theoretical knowledge in practice, improve students interest and enthusiasm in learning, enhance the practicality of the course.

4.2 Establish a Complex of Meteorological Informatics Cross and Integrated Courses in an Orderly Manner

Multimedia and interactive teaching and virtual simulation teaching are adopted to establish an orderly meteorological information cross-fusion curriculum system. Multimedia and interactive teaching makes abstract knowledge intuitive and vivid through pictures, videos and animations, and demonstrates animation phenomena such as meteorological satellite operation to enhance students understanding. At the same time, the application of information technology in meteorology to stimulate the interest in learning. Interactive teaching improves

students participation and learning effect by asking questions, discussing and case analysis. For example, asking students to discuss in groups to solve practical meteorological data processing problems. The use of the online platform also facilitates the students learning and communication. Statistics show that this teaching method can significantly improve students interest and learning effect, while cultivating teamwork and innovation ability. Virtual simulation technology in the simulation of meteorological phenomena and science and technology application scenarios, let students practice in the virtual environment, improve the practical ability. For example, virtual reality technology can simulate the weather radar work and data acquisition process, allowing students to experience the practical operation. Moreover, virtual simulation improves the security and reproducibility of teaching, avoids dangers in real operation, and allows repeated experiments to consolidate skills. Virtual simulation technology also increases the interest and attraction of teaching, through the creation of realistic virtual environment, improve students interest and enthusiasm. For example, the application research of VR/AR technology shows that it can provide immersive teaching experience, display teaching content in an all-round way, meet students practical training needs, provide teachers with new teaching methods for teachers, enrich classroom content and improve teaching efficiency

4.3 Strengthen the Training of Scientific Knowledge of Meteorological Teachers

To improve teachers professional quality and team communication and improve the level of teachers scientific knowledge. It is crucial to improve teachers professional quality in the field of meteorology and information science. Teachers can participate in professional training, such as the integration of meteorology and information science training, learn new equipment and technology, and master the application of big data and artificial intelligence in the field of meteorology. Participation in scientific research projects also helps teachers understand the frontiers of the subject and integrate research results into their teaching. In addition, teachers can use the online platform to learn independently to broaden their knowledge. Teacher teamwork and communication are very important to curriculum construction. Teachers from different backgrounds can complement each others strengths and jointly study interdisciplinary projects, such as using virtual reality technology to improve eaching results. Teachers can exchange teaching experience through seminars and salons to solve teaching problems together. Cooperation and communicating with domestic and foreign institutions, inviting experts to give lectures and attending international conferences will help to improve the overall level of the teacher team and support the curriculum construction.

5 Conclusion

This paper discusses the curriculum reform and practice of the integration of meteorology and information science. First, by listing issues such as the low level of informatization in traditional atmospheric science, the difficulty of integrating meteorology with information technology, and the need for improvement in teachers' scientific literacy, it points out the challenges in the construction of interdisciplinary meteorological courses in universities. Second, in response to these problems, the article proposes measures to promote the construction of integrated meteorological information courses in universities, including transforming the concept of curriculum construction, optimizing the curriculum combination, and promoting the reform of talent training models. It also proposes the necessity and specific implementation measures for the curriculum reform of the integration of meteorology and information science, including improving teaching quality and students' practical abilities through case-based teaching, multimedia teaching, online platforms, etc.; optimizing the curriculum system, adding interdisciplinary courses; establishing internship bases, strengthening teacher training and academic exchanges to improve teachers' scientific literacy and teaching levels. The aim is to cultivate interdisciplinary talents through interdisciplinary education and promote the coordinated development of the two disciplines.

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