

Constructing the Information-Based Teaching Mode and Course System of the Information and Computing Science Speciality

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Abstract—The paper presents our research on constructing the information-based teaching mode and course system of the Information and Computing Science (ICS) speciality. Firstly, it introduces the background and the significance of the research. Then, it presents the research content, implement scheme and process. Finally, it gives the goal and feature of the research.

Index Terms—Course, education reform, information, Information and Computing Science, teaching.

I. INTRODUCTION

A. Background

The speciality of Information and Computing Science belongs to Mathematics, which contains not only many core and extended courses of computer science, but also many important basic courses of Mathematics, such as Mathematical Analysis, Advanced Algebra, Discrete Mathematics, Probability Theory and Statistics. Constructing the information-based teaching mode and course system of the ICS speciality is a promising topic. With the development of computer technology and related science, it has been gradually recognized and proposed by university teachers in recent years. However, the research on this topic is still in its infancy [1]-[8]. Therefore, the research on this topic will be of great value to the educational reform, especially to the applied majors and applied colleges and universities.

Constructing the information-based teaching mode and course system of the ICS speciality is a short name for teaching courses using information-based teaching methods and means for the ICS speciality. It is the product of the trend of information technology in disciplines. It can cover the core professional courses of the major of ICS, such as Mathematical Analysis, Advanced Algebra, Probability Theory and Statistics, Numerical Analysis, Discrete Mathematics, C Language and Program Design, Computer Composition Principles, Computer Networks, Data Structure, Operating Systems, Database Principles and Applications, Web Basis, Introduction to Artificial Intelligence, etc. [1]. It can also cover professional expansion courses for the major of

ICS, such as C++ Programming, Assembly Language, Java Programming, Python Language, Software Engineering, Linux Platform Technology, Java Web Development Technology, Hadoop Big-Data Platform, etc [2]. The system is based on professional theoretical knowledge of information science, with computer as the tool and network as the platform. In the teaching process of basic theory, comprehensive use of computer and network and experiment skills will be utilized, teachers not only explain, analyze, deduce, and express the theory of professional courses in the classroom, but also lead students to strengthen the research and learning of professional courses through online interaction, online answers, computer room experiments and other ways. Students' understanding of theoretical knowledge will be enhanced, and students' abilities of practical application and practical operation will be cultivate.

Constructing information-based teaching model and course system of ICS is an inevitable result of the progress of the times. With the maturity of the technologies, the collection, analysis, processing and application of course information become convenient, flexible and rapid, which makes the research of this topic full of vitality, and become the frontier of the research field of educational reform in the new era.

Constructing the information-based teaching mode and course system of the ICS is an urgent need for the development of the ICS speciality. The major of ICS contains not only theoretical courses which are dull in learning process, but also skills courses which are closely related to practical technology in our modern society. If the skill courses are taught as theoretical courses, the students will be trained like whom only can talk about military affairs on paper, but cannot combine theoretical knowledge with practice, and cannot skillfully apply the knowledge to practice. To deal with practical problems, it is an urgent need for the current development of the major of ICS to construct the information-based teaching mode and course system.

Constructing the information-based teaching mode and course system of the speciality of ICS is the requirement of higher education reform. From the current higher education



system, although many professional courses have integrated many modes such as computer+, internet+, online and offline mixing [1]-[4], universities still lack deep research and construction of systematic teaching methods for information-based teaching model and course system of ICS speciality. In the long run, the existence of these problems is extremely harmful to the training of professional personnel in the field of ICS in our country.

B. Significance

The research topic of constructing information-based teaching model and course system of the ICS innovatively puts forward the idea that the ICS speciality teaching should serve with network and computer. At the same time, it also puts forward higher requirements for the training of university ICS professionals, clarifies the relationship between teaching, learning, examination and use, and clarifies the knowledge structure and training objectives that the students of the ICS speciality should master. It can well solve the common phenomena that exist in the current education of the ICS speciality, such as the disjointing of teaching and learning, examination and use.

The research on constructing the information-based teaching model and course system of the ICS Speciality will deeply analyze the position and role of the Computer Course in the ICS Speciality on the basis of the practical experience of the information technology teaching in China and the characteristics of combining the mathematical theory courses with the computer application technological courses of the ICS Speciality. We should design and develop informationization teaching courses and teaching methods for undergraduates majoring in ICS, strengthen students' in-depth mastery and application of computer-related knowledge, so as to cultivate compound professionals with solid professional knowledge of ICS and rich computer application technology [5]-[6].

The development of the research on constructing information-based teaching mode and course system of the ICS speciality will be helpful to train students with the core competence of the professional technology of ICS, as well as the following abilities: modeling, solving, comprehensive processing, statistical and data analysis capabilities and multimedia processing capabilities of the major of ICS. The abilities of program design and project development, information system practice and application in the speciality of ICS will further improve the modernization of information and computing science in China [7]-[8].

II. RESEARCH CONTENTS, SCHEME AND PROCESS

A. Research Contents

① Objectives

The research includes the construction of information-based teaching system, theoretical course system

and experimental course system of information and computing science speciality, through the use of these innovative teaching methods and the setting of innovative courses. It can effectively cultivate the ability of combining theory expertise with computer practice skills, enable students to clarify the learning direction, stimulate innovation ability, and actively show themselves, so as to promote the development and progress of ICS profession.

② Content

- In the teaching content, in combination with the study and experiment of courses such as computer application basis and computer program design, it can strengthen the students

in-depth study and the ability to solve applied problems in theoretical courses such as Advanced Mathematics, Discrete Mathematics, Data Structure and Operating System, and train students to use network technology and computer operation technology, and the ability of modern techniques such as programming to be applied in practice.

- In the course design, part of the content takes the self-study on students' websites and platforms, and advanced mixed teaching of discussion and student display in class. All content is pre-class (online preview) - in-class (online interactive learning) - after-class (online extension). Combining multiple modes such as application-based case analysis, situational case discussion, flipping classroom training, and using modern communication methods such as network, mobile phone, computer, etc., to expand the comprehensive experimental links such as on-line experiment and practical training, students can not only master basic theoretical knowledge, but also think independently, teamwork, logical thinking, language expression. Students can be universally trained in many qualities, such as text expression, learning mathematical modeling, software use, writing program, website design, network management, project development, and so on. It combines well the knowledge and skills of each course of the ICS speciality, and make students understand the status of theoretical knowledge and the application of computer technology, form rigorous logical thinking and reasoning ability, master project development and design ability, and increase team cooperation awareness and collaboration ability.

③ Key Issues

- Design and develop informationization teaching courses and teaching methods for undergraduates majoring in ICS in a specific way, so as to make handouts and course design more practical, and to deeply analyze the key technologies of computer application. It will cultivate students' abilities of comprehensive processing of information, related program design and project development, and basic abilities of information system application. It will lay a good foundation for the follow-up study of the professional courses of ICS.

- Provide a diversified and interactive learning environment. Provide the teaching outline, teaching materials,



teaching programs, teaching courseware, teaching videos, experimental course design, experimental source code, teaching resource materials, etc. through the website platform, and fully open and share the teaching resources.

B. Implementation Scheme

① Plan

The specific implementation scheme and method of this project are based on the construction of information technology theory teaching system for the ICS speciality and information technology experimental teaching system for the ICS speciality. Through in-depth analysis of the key points, difficulties and features of this course, students are required to master theoretical knowledge; and at the same time, practical teaching is mainly carried out, including on-line experiments and practical training. It also uses innovative teaching concepts, heuristic teaching methods and student-centered teaching methods to generate the innovative and active thinking consciousness germinate and grow healthily in the process of imperceptibility and learning practice.

② Method

- Organic combination of theoretical courses and applied courses. On the basis of teaching the theoretical courses of the ICS speciality, teachers describe the application of computer technology combined with theoretical knowledge. On the basis of teaching computer program design and computer speciality courses, teachers narrate the related theory knowledge of the major of telecommunications and its application in computer technology, including the application of theoretical knowledge in the establishment, analysis, derivation, validation and program writing, database establishment, website design, computer operation, project development and maintenance, etc. Thus, a complete information-based teaching model and course system for the speciality of ICS will be formed.

- Systematically establish the information-based teaching model and course system for the speciality of ICS. The teaching mode and course system include handouts, courseware, experimental design, experimental handouts and websites, teaching videos, network teaching platforms, etc.

- Using case-based teaching method. The main feature of this method is that it enables students to change from passive listening to active thinking, and actively explore knowledge in related unknown areas driven by clear needs. Under the guidance and inspiration of teachers, students gradually use their knowledge of computers and networks to explore, analyze and try to solve problems. In this way, students not only feel new and not dull, but also achieve good teaching results and make students memorize deeply.

- Enable the process of network interaction, answering questions, and operation. Make full use of the conditions of network teaching resources and establish online interaction, online discussion, online test, online homework, online answer and other links. Teachers discuss and communicate

with their students on the difficulties of teaching. Students can submit their own homework and questions on the network in or out of class, so that students' learning activities can be established in a more scientific, open, standardized, and efficient teaching platform.

- Implement network-based teaching mode. A teaching website platform to teach in multimedia classrooms and computer rooms will be set up. The theoretical and experimental classes are closely combined, answer in time, and practice while speaking. This enables students to practice the new knowledge in a short time and effectively improve the teaching effect.

C. Implementation Process

- The first stage: revise and improve the teaching outline, consolidate the teaching implementation scheme, further improve the course teaching plan and teaching materials, develop characteristic teaching content, compile a database of teaching and performance evaluation questions (themes/cases), strengthen teaching reform research, compile characteristic teaching materials or teaching research papers adapted to the training of new era ICS professionals.

- The second stage: reasonably organize a group of experienced course teachers, build abundant teaching resources online and offline, set up a fully functional experimental platform, introduce excellent resources into the classroom, and establish the information technology professional education mode and course system of online + offline and theory + experiment.

- The third stage: Deepen the reform of the course contents and teaching methods, further summarize the teaching methods of each part of the course, continuously improve the teaching process design, summarize the results of teaching and research, compile teaching and research papers, improve the influence and reproducibility of the course, and further optimize the information-based teaching mode and course system of the ICS speciality. After the construction is mature, use a variety of ways such as network. Continue to promote outside the school to form teaching and curriculum standards for professional training.

III. CONCLUSION

The educational goal of this research is to train "compound" professionals who have not only solid basic knowledge of the ICS speciality, but also rich computer and other applied technologies, i.e.:

- During the implementation of this research, detailed teaching plans, teaching contents and teaching programs will be formulated according to the requirements of computer technology application and the law of training professionals in the ICS Speciality, and theoretical and experimental teaching hours will be rationally allocated, through innovative and practical information-based teaching models with characteristics of the ICS Speciality. Students' self-learning

ability will be fully cultivated, and their ability to skillfully use computer technology to solve practical problems in professional related fields will be enhanced.

- The development of this research will provide a good theoretical discussion, guidance and practical operation platform for the organic integration of theoretical knowledge and computer technology of the ICS Speciality in the university, and will further the reform and innovation practice of the education of the ICS Speciality. Promotion of information technology education in other specialties or colleges lays a solid foundation, and lays a good foundation for students to better learn their professional knowledge.

- This research will take into account the scientific and systematic nature of the points of knowledge and skills in computer technology teaching, form a complete chain of knowledge and ability, and scientifically and reasonably construct the university computer basic and applied knowledge structure for the undergraduates of the speciality of ICS.

This research has the features and innovations as follows:

- It analyses the training characteristics of the knowledge structure of the ICS professionals in the 21st century, reorganizes and optimizes the theoretical and applied teaching modes and curriculum system of the ICS profession, constructs the teaching mode and curriculum system suitable for the training of the applied talents of the ICS profession, and creates new ideas for the education of the ICS profession.

- It adopt innovative teaching concepts, i.e., around the key and difficult points in the teaching of ICS speciality, it introduces innovative methods in related fields. By introducing these new concepts, ideas and technologies, we can help students deeply remember the teaching key and difficult points, and at the same time, make the innovative consciousness germinate and grow healthily in the subtle and scientific thinking.

- It use heuristic teaching concepts, i.e., teachers give a thorough explanation of the focus of theoretical teaching so as to enable students to do the same thing. Since the major of ICS is a practical science, it is necessary to give a detailed explanation of the experimental methods used to reach this important conclusion so that students can understand and keep the teaching focus in mind.

- It combines closely with the theoretical knowledge and application-oriented orientation of the speciality of ICS, integrates the new teaching mode in four aspects: teaching, learning, examination and application, and adopts innovative teaching mode and quality control measures so as to make the actual teaching effect remarkable and distinctive.

- It combines with the training needs of applied talents in the speciality of ICS, designs the informationization theory and experiment course system of the speciality closely related to the comprehensive processing ability of information,

related program design and project development ability, basic ability of information system application of the speciality of ICS. It clarifies the direction of practical application and fully embodies the characteristics, systematisms, scientificity and advancement of the ICS speciality in experimental teaching.

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