Reflections on the construction of first class curriculum based on signals and systems

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Abstract. In the context of the Internet and information age, China's higher education continues to develop towards intelligence and digitization, and the corresponding educational and teaching methods have also undergone changes. As one of the key courses in most universities of science and engineering, "Signal and Systems" is a fundamental and practical course that students must learn. Teachers should keep up with the times in theoretical and practical teaching, constantly update teaching methods, effectively combine online teaching using information technology with offline classroom teaching, and create a "learning centered" online and offline hybrid first-class course. Curriculum is the most micro issue in education, the "last mile" that embodies the concept of "student-centered development", and the concretization, operationalization, and objectification of the fundamental standards of "cultivating virtue and cultivating effectiveness". The curriculum construction in the new era should reflect the requirements of "high-level, innovative, and challenging".

1 Introduction

In order to implement the "Implementation Opinions of the Ministry of Education on the Construction of First Class Undergraduate Courses", further promote the classroom teaching revolution, improve the level of curriculum construction, and improve the quality of talent cultivation, our school has carried out the "One Teacher, One Excellent Course" and the recognition and construction of first-class courses at the school level.

Signal and Systems is a comprehensive discipline based on numerous disciplines, covering a wide range of knowledge points and playing a connecting role in all related majors. The school offers this course to seamlessly connect with students' majors, making it easier for students to learn related follow-up courses after learning this course. The main purpose of studying this course is to help students understand the time domain The analysis of transformation domain and professional related knowledge content, the knowledge points of this course are relatively abstract, and students need to have a certain level of knowledge conversion ability and mathematical, physical, and engineering concepts when learning. In teaching, teachers also need to proceed from signal to system, and then combine signal analysis to analysis system, followed by system design, and gradually explain to improve students' learning.

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The goal of building first-class courses in local application-oriented undergraduate universities is to cultivate students' comprehensive qualities, enhance their practical application abilities, and turn them into application-oriented talents with a high sense of social responsibility and innovative and hardworking spirit, meeting the needs of local economic development and grassroots work. We have conducted some exploration and reflection on how to improve students' practical abilities, analyze and solve complex problems, and innovate training abilities in the teaching of this course, and how to make the course meet the first-class curriculum standards.

2 Characteristics and innovation points of the course "signals and systems"

2.1 Course features

2.1.1 Classroom teaching adopts project-based teaching to optimize teaching

Collaborate with ZTE schools and enterprises, combine with the direction of smart cities, carry out project-based teaching, reconstruct educational concepts, group interaction, and collaborative innovation.

2.1.2 Normalization of ideological and political education

Based on the characteristics of the course, incorporating elements such as industry norms and scientific stories, cultivating students' awareness of serving the country through science and technology, a spirit of craftsmanship that strives for excellence, and innovative and entrepreneurial abilities.

2.1.3 Diversified assessment methods

Highlight project assessment and innovative assessment, and increase the proportion of process performance.

2.2 Innovation points

2.2.1 Innovative "223" blended teaching mode

Based on the OBE concept, student-centered and output oriented, the "223" blended and project-based teaching model is adopted. Improve students' self-learning ability and ability to develop and apply information processing systems.

2.2.2 Collaborating with ZTE school enterprises

Collaborate with ZTE schools and enterprises to highlight the innovative characteristics of smart cities, strengthen project teaching and off campus practical training, encourage students to participate in innovation and entrepreneurship, Blue Bridge Cup competitions, laboratory open projects, etc., stimulate learning interest, and improve engineering application abilities.

2.2.3 Constructing a three step practice system and creating a new model of practical teaching

Building a three-level practical system that combines basic experiments using experimental boxes, MATLAB based, virtual simulation experiments, and engineering projects, relying on both internal and external experiments and training bases. Adopt group collaboration and self exploration methods to conduct experimental demonstrations, result demonstrations, and defense, and cultivate practical abilities.

2.2.4 Added modules to assist in postgraduate entrance examination and certification

This course is a professional course for postgraduate entrance examination. In addition to the Learning Pass, modules such as Assistance for postgraduate entrance examination and certification are added to provide hierarchical teaching to meet students' needs for postgraduate entrance examination and certification.

3 Basic construction ideas for the first class course of signal and systems

3.1 Update teaching concepts and adopt blended teaching design

Focusing on cultivating students' abilities in signal and system development and application, project-based teaching is carried out to highlight the role of students as the main body; Fully utilize information technology, comprehensively utilize exploratory teaching, case teaching methods, etc., implement three-step progressive project-based and hierarchical teaching, stimulate students' learning interest, strengthen interaction, and build a learning community between teachers and students. Based on the perspective of electronic information engineers, build a project oriented and task driven "223" hybrid teaching model. Focusing on the cultivation of research, design, and development capabilities in information systems; Utilizing the two classrooms of "online+offline", binary integration, and "in class+out of class" to complement each other in time and space, "pre class cognition+in class exercises+post class expansion", with three stages of advancement; Realize the visualization of project simulation, effective classroom feedback, enrichment of the second classroom, and diversification of assessment and evaluation.

This model adheres to the student-centered approach, implements project-based and blended teaching, creates an innovative classroom for efficient interaction and deep learning between teachers and students, and constructs a learning community for teachers and students.

3.2 Clarify teaching objectives

Highlighting the student-centered approach, emphasizing output orientation, and combining the OBE concept, the goal of organizing knowledge, abilities, and qualities is formed to form a goal system. Based on the positioning of the school's "application-oriented undergraduate" talent cultivation and the requirements of constructing majors according to provincial-level first-class professional standards, and in accordance with the training objectives of innovative talents in the field of electronic information engineering at our school, the course objectives of this course are determined as follows.

1. Knowledge objectives:Master the basic concepts of signals and systems, principles and methods of time-domain and frequency-domain analysis, and their applications in smart cities and electronic information engineering.

2. Capability objective: To be able to adopt suitable solutions for expression, design, and processing based on the characteristics and processing requirements of signals, and gradually develop a comprehensive ability and high-order thinking to analyze and solve complex engineering problems in the field of signal and information processing; Possess the ability to process simple signals, analyze communication small systems, and optimize systems.

3. Quality objectives: Guide students to develop their interest in their major and industry, cultivate their spirit of craftsmanship, teamwork, and innovation, establish a sense of national pride, and inspire students' patriotism and mission to serve the country through technology.

3.3 Optimize teaching content and promote organizational implementation

The selection of teaching content should be targeted at the needs of vocational positions, guided by helping students improve their engineering application ability, innovation and entrepreneurship ability, and enhance their employment level, deepen school enterprise cooperation, and integrate basic theoretical knowledge of the course with engineering practice. Adhere to project driven approach, highlight application principles, combine teaching syllabus and job requirements, target practical engineering applications, select practical cases for project-based teaching, and focus on cultivating students' innovative and entrepreneurial concepts and awareness.

Integrate the teaching content into: overview of signals and systems, time-domain analysis methods of systems, transformation domain analysis methods of systems, application modules of signals and systems, namely two systems, two types of methods, and three major transformations. Integrating cutting-edge technologies such as smart cities and 5G communication into classroom teaching; Integrate enterprise projects and curriculum ideological and political education into the classroom, cultivate students' awareness of technological power and craftsmanship spirit. Combining virtuality and reality, strengthening practice. The LTI system simulation analysis platform based on MATLAB user graphical interface is applied to teaching, which is vivid and helps students understand abstract definitions, effectively improves teaching efficiency, and stimulates students' interest in learning.

The "Super Star Learning Pass" software effectively combines traditional teaching with online teaching through the "online+offline" mode, with functions such as attendance check in, classroom interaction, online testing, etc. Students can study anytime and anywhere, and can provide timely feedback and solutions when encountering problems. Adhering to the educational tenet of "student-centered" has mobilized students' enthusiasm for learning, laying a solid foundation for students to master basic knowledge of signals and systems, as well as their ability to operate experiments and practical training.

Interaction between industry and academia, promoting curriculum reform. The course adopts a practical teaching model that combines "industry, academia, and research" in class and outside of class. Integrating curriculum reform, scientific research training, and curriculum design, with a focus on cultivating students' research, innovation, and engineering practice abilities. Continuously integrating cutting-edge theories and the latest technological achievements in teaching and research into teaching practice, integrating teaching and research, and achieving a combination of learning and research. Relying on the research platform and projects of ZTE Enterprise, introducing mature research achievements into the cultivation of students majoring in Electronic Information

Engineering is beneficial for improving students' hands-on practical and engineering innovation abilities.

Stratified teaching is provided for students' postgraduate entrance examination and employment certification, with the addition of assistance modules for postgraduate entrance examination and employment certification on the Learning Pass. Effectively taking care of students' differences and meeting the needs of personalized learning.

3.4 Enrich teaching resources

Adopting a teaching resource construction mechanism that promotes construction through use, co construction and sharing, open construction, and dynamic updating, based on granular resource construction and structured design as the framework, we continuously build and improve curriculum basic resources and expand resources.

Diversified types and abundant quantities of built resources; An open teaching resource library with a high proportion of non-text resources such as animation, virtual simulation, video, audio, etc.

The specific implementation measures are as follows:

1. Fragmented teaching resources. Resource construction should be designed to minimize learning materials as much as possible, with granular storage to facilitate students' retrieval and search for resources based on different learning needs.

2. Structured design teaching resources. Reasonably layout and structurally design the teaching resource library to avoid only focusing on "massive" resources while neglecting their teaching and applicability. Gradually upload the pre prepared teaching resources to the internet.

3. Improve the basic teaching resource library and build an expanded resource library. While improving the basic resource database, we will also build relevant materials including industry trends, job requirements, and postgraduate entrance examination question banks for students to conduct independent exploration and deeper research-oriented learning.

3.5 Improve the evaluation method of course grades

Integrating signals and systems with smart cities, emphasizing the assessment of process performance such as experimental and practical training projects and comprehensive scores in learning and communication.

This course is an exam course and is conducted in the form of a closed book exam. The distribution of grades is as follows:

1. Final exam scores account for 60%;
2. The mid-term exam score accounts for 10%;
3. Daily grades account for 30%.

4 Conclusion

We will improve the construction of practical teaching bases, further cultivate students' ability to solve practical engineering problems, integrate cutting-edge knowledge such as the information industry and smart cities, build a new student-centered and output oriented hybrid teaching ecosystem, carry out curriculum reform, and provide more personalized learning services such as postgraduate entrance examination and certification. Only by building first-class courses can the construction of first-class majors have confidence, and the construction of first-class disciplines and universities can be guaranteed. We will

comprehensively carry out first-class curriculum construction, establish new concepts in curriculum construction, promote curriculum reform and innovation, implement scientific curriculum evaluation, strictly manage curriculum, improve teachers' teaching abilities, and form a diverse and diverse teaching content and curriculum system, laying a solid foundation for comprehensively improving the quality of education.

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