

Construction and Practice of the Four-Micro Integration Teaching System for Chemical Engineering Majors in Universities: A Case Study of the Bilingual Course Chemical Literature Retrieval and Scientific Paper Writing

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Abstract

Under the requirements of high-quality development of higher education in the new era, comprehensively eliminating "low-quality courses" and creating "high-quality courses" with high-level, innovative and challenging features have become the core task for the connotative development of chemical engineering majors in universities. Aiming at the problems existing in some current professional courses, such as boring content, single form, insufficient interaction and weak practice, Ms. Zuo Yujing from the School of Chemistry and Chemical Engineering, University of Jinan, relying on the advantages of new media interactive technology, has constructed a new "Four-Micro Integration" teaching system integrating micro-platform, micro-course, micro-class and micro-communication in the whole teaching process including teaching design, lesson plan compilation, classroom teaching, student experiment and internship. This system realizes efficient interaction between teachers and students anytime and anywhere, promotes the transformation of classroom teaching from "passive indoctrination" to "active inquiry", and achieves the teaching goal of teaching through fun and improving quality and efficiency. Taking the bilingual course "Chemical Literature Retrieval and Scientific Paper Writing" as the practical carrier, this paper systematically expounds the connotation construction, implementation path and application effect of the "Four-Micro Integration" teaching system, providing a reference model for the curriculum reform and "high-quality course" construction of chemical engineering majors in universities.

Keywords

Chemical Engineering Major; High-Quality Course Construction; Four-Micro Integration; Literature Retrieval; Scientific Paper Writing; Bilingual Teaching;

Teaching Reform

1. Introduction

With the entry of China's higher education into a new stage of connotative development centered on quality improvement, eliminating "low-quality courses" and creating "high-quality courses" have become key measures to deepen the reform of undergraduate education and teaching and improve the quality of talent training. As a highly practical and innovative engineering major, chemical engineering's curriculum system is directly related to the cultivation of students' scientific research literacy, engineering ability and innovative spirit. However, in some universities, the related courses of chemical engineering still have prominent problems such as traditional teaching mode, dull classroom atmosphere, disconnection between theory and practice, and insufficient interaction between teachers and students, which are difficult to stimulate students' learning interest and easily become low-level and repetitive "low-quality courses".

To solve this dilemma and promote the high-quality development of chemical engineering major, Ms. Zuo Yujing from the School of Chemistry and Chemical Engineering, University of Jinan, has actively explored innovative teaching paths, made full use of new media and new technologies to build flexible and efficient teaching carriers, and systematically adopted the combination of micro-platform, micro-course, micro-class and micro-communication to carry out educational and teaching activities in the whole process of teaching design optimization, standard lesson plan compilation, classroom interaction organization, student experiment and internship practice. A new "Four-Micro Integration" teaching system that can break the time and space constraints and realize efficient interaction between teachers and students anytime and anywhere has been constructed. Guided by teaching through fun, this system effectively improves classroom attractiveness and teaching effectiveness, injects new vitality into the bilingual course "Chemical Literature Retrieval and Scientific Paper Writing" which is both instrumental and academic, and also provides a reference practical plan for the transformation and upgrading of similar professional courses from "low-quality courses" to "high-quality courses".

2. Connotation and Construction Concept of the "Four-Micro Integration" Teaching System

(1) Core Connotation

The "Four-Micro Integration" teaching system is characterized by miniaturization, interaction, convenience and integration. Relying on new media technology, it decomposes teaching activities into lightweight, high-frequency and easy-to-participate micro-units, realizing in-depth integration of online and offline teaching and seamless connection between in-class and after-class learning. It

specifically includes four core modules:

Micro-platform: Relying on new media carriers such as WeChat official account, Learning Pass, Rain Classroom and short video platforms, build an all-weather online teaching support platform to provide digital carriers for teaching resource push, task release, interactive Q&A and achievement display;

Micro-course: Decompose the course knowledge points into short, concise and focused micro online course resources, such as micro-course videos, electronic handouts, bilingual terminology cards and retrieval operation guides, to adapt to students' fragmented autonomous learning;

Micro-class: On the basis of traditional classrooms, carry out short, efficient and theme-focused micro offline classes, focusing on task-driven, case discussion and practical exercises, highlighting students' dominant position and improving classroom participation;

Micro-communication: Establish an immediate and regular micro-communication mechanism between teachers and students, and students and students, realizing communication and feedback anytime and anywhere through group discussion, one-on-one Q&A, message interaction and achievement mutual evaluation, breaking the time and space barriers of classrooms.

The four modules support each other and integrate organically, forming an integrated teaching pattern of "platform support, course empowerment, classroom implementation and communication guarantee", making the teaching process more flexible, interaction more sufficient and experience more pleasant, and truly realizing teaching through fun.

(2) Construction Concept

With the fundamental goal of "creating high-quality courses, improving quality and serving students", this system is based on the actual situation of talent training in the chemical engineering major of University of Jinan, adhering to the concepts of student-centered, outcome-oriented, information technology integration and teaching through fun: taking solving the pain points of "low-quality courses" as the orientation to solve the problems of traditional classrooms such as dullness, inefficiency, insufficient interaction and weak practice; taking new media technology as the starting point to expand teaching time and space, enrich teaching forms and improve course attractiveness; taking ability training as the core, giving consideration to knowledge imparting, skill training and academic literacy cultivation; taking bilingual teaching as the feature, adapting to the international needs of chemical literature retrieval and paper writing, and improving students' professional foreign language application ability.

3. Specific Construction and Implementation of the "Four-Micro Integration" Teaching System in Bilingual Courses

(1) Micro-platform: Building a Digital Teaching Carrier to Realize All-Weather

Teaching Support

The micro-platform is the basic carrier of the "Four-Micro Integration" system, providing an all-weather and mobile operating environment for course teaching. Combining the characteristics of the bilingual course "Chemical Literature Retrieval and Scientific Paper Writing", the School of Chemistry and Chemical Engineering, University of Jinan, has built a multi-coordinated micro-platform system: relying on teaching platforms such as Learning Pass and Chaoxing Fanya, build an exclusive online space for the course to release bilingual teaching syllabuses, courseware, assignments and assessment tasks; use WeChat official account and video account to push lightweight knowledge such as professional terminology, English abstract examples and database retrieval skills, facilitating students to learn anytime in their spare time; use tools such as Rain Classroom and Questionnaire Star to carry out classroom check-in, immediate questions and in-class tests, realizing real-time feedback of teaching data; build an exclusive communication group as the main position for teacher-student micro-communication, timely answering various questions such as literature retrieval, paper writing and bilingual expression.

Through the micro-platform, the pre-class, in-class and after-class teaching links are connected as a whole, breaking the time and space constraints of traditional classrooms, extending teaching services to the whole process of students' learning, and providing a solid technical guarantee for the regular and convenient implementation of bilingual courses.

(2) Micro-course: Developing Lightweight Bilingual Resources to Meet Fragmented Autonomous Learning

Micro-course is the core content of the "Four-Micro Integration" system. Aiming at the characteristics of bilingual courses with many knowledge points, strong professionalism and high language difficulty, it decomposes complex content into lightweight and easy-to-absorb micro learning resources, effectively reducing the learning threshold and improving learning efficiency. In terms of knowledge point decomposition, the course is divided into multiple micro-units such as literature database retrieval, scientific paper structure analysis, Chinese and English abstract writing, chart standard production, reference format and academic misconduct prevention, each corresponding to a 5-10 minute micro-course video; in terms of bilingual resource construction, bilingual terminology comparison cards, English journal sample intensive reading micro-courses and bilingual writing template libraries are made, giving consideration to professional knowledge learning and foreign language ability improvement; in terms of practical resource development, practical micro-videos of databases such as SciFinder, Web of Science and CNKI are recorded, and directly applicable micro-materials such as bilingual writing examples and literature review templates are provided.

Micro-course resources are short, concise, focused and reusable, adapting to students' fragmented learning habits, effectively solving the problems of long content,

high understanding difficulty and difficulty in repeated learning of traditional courses, enabling students to gradually master bilingual literature retrieval and writing skills.

(3) Micro-class: Innovating Classroom Organization Form to Create an Efficient Interactive Teaching Scenario

Micro-class is the main position for the implementation of the "Four-Micro Integration" system. Adhering to the principles of "short and efficient, teaching through fun and highlighting practical operation", it changes the traditional one-way teaching mode of teachers and builds an interactive classroom with students' active participation. In terms of classroom design, the "big theme + small task" form is adopted, dividing each class into multiple 10-15 minute micro-class modules, carrying out activities such as key knowledge explanation, bilingual reading, retrieval practice, fragment writing and group presentation respectively; in terms of teaching methods, case teaching, task-driven and situational simulation are integrated, such as assigning cutting-edge chemical engineering research topics and asking students to complete Chinese and English literature retrieval, abstract writing and group report within a time limit; in terms of bilingual implementation, bilingual activities such as keyword reading, sample reading and bilingual Q&A are carried out to improve students' professional foreign language application ability and avoid bilingual teaching becoming a mere formality; in terms of experimental practice extension, micro-class is combined with students' experimental and internship links, guiding students to write Chinese and English experimental reports and small papers based on experimental data, realizing seamless connection between theoretical teaching and practical application.

The micro-class is flexible in form and relaxed in atmosphere, which can fully mobilize students' enthusiasm, make the classroom "lively", effectively improve the classroom attendance rate and participation, and promote the course to transform into a high-level "high-quality course".

(4) Micro-communication: Building a Regular Interactive Mechanism to Realize Whole-Process Precise Guidance

Micro-communication is the guarantee link of the "Four-Micro Integration" system. By establishing an immediate, equal and regular communication mechanism, it realizes communication between teachers and students anytime and anywhere, solves students' learning doubts and strengthens process guidance. In terms of communication forms, various methods such as in-class micro-discussion, group micro-mutual evaluation, after-class micro-Q&A and online micro-message are adopted, and teachers timely feedback on students' literature retrieval results, paper writing fragments and bilingual expression errors; in terms of communication content, it includes not only professional knowledge Q&A, but also learning method guidance, academic standard reminder and scientific research interest cultivation, giving consideration to knowledge learning and value guidance; in terms of communication timeliness, immediate reply is realized relying on the micro-platform

to avoid problem accumulation, enabling students to obtain timely feedback and encouragement in the learning process and enhance their sense of learning achievement; in terms of student-student communication, group mutual assistance and achievement sharing micro-activities are organized to promote students to learn from each other and make progress together, creating a relaxed and pleasant learning atmosphere and truly realizing teaching through fun.

4. Practical Characteristics and Construction Effects of the "Four-Micro Integration" Teaching System

(1) Practical Characteristics

Based on the construction of "high-quality courses", targeting the pain points of "low-quality courses" With the goal of improving the high-level, innovative and challenging nature of courses, through the joint efforts of micro-platform, micro-course, micro-class and micro-communication, solve the problems of traditional classrooms such as dullness, inefficiency, insufficient interaction and weak practicality, and transform the classroom from "passive acceptance" to "active inquiry".

Integrating new media technology to realize teaching through fun Make full use of interactive media technologies familiar to young students, and reduce learning difficulty and improve learning interest with lightweight, interesting and convenient teaching forms, making serious academic courses more approachable and attractive. Adapting to the needs of bilingual teaching and highlighting professional application ability Bilingual elements are integrated into all links of the "Four-Micro Integration", including the development of bilingual micro-resources, the conduct of bilingual micro-classes and the organization of bilingual micro-communication, effectively improving students' ability in English literature retrieval, reading and scientific paper writing, and adapting to the international development needs of chemical engineering major.

Covering the whole teaching process and supporting experimental and internship practice teaching Extend the "Four-Micro Integration" model to practical links such as experimental teaching, professional internship and thesis proposal, realize in-depth integration of theoretical teaching and practical training, and strengthen students' practical ability and scientific research literacy.

(2) Construction Effects

Through the implementation of the "Four-Micro Integration" teaching system, the teaching quality of the course "Chemical Literature Retrieval and Scientific Paper Writing" in the School of Chemistry and Chemical Engineering, University of Jinan has been significantly improved: the classroom atmosphere is more active, students' learning enthusiasm and participation have been significantly improved, effectively realizing teaching through fun; students' literature retrieval efficiency and the standardization of Chinese and English paper writing have been greatly improved,

and their awareness of academic integrity has been significantly enhanced; the high-level and challenging nature of the course has been continuously improved, gradually realizing the transformation from "low-quality course" to "high-quality course"; it has accumulated replicable and promotable practical experience for the curriculum reform of chemical engineering majors in universities, and effectively promoted the high-quality development of the major.

5. Deficiencies and Optimization Directions

In the practice process, the "Four-Micro Integration" teaching system still has some deficiencies: for example, the update speed of micro-resources needs to be further accelerated, the depth of bilingual teaching needs to be strengthened, some students' autonomous learning habits need to be cultivated, and the combination with industry and enterprise practice can be further deepened.

In the future, continuous optimization can be carried out from the following aspects: further enrich the micro-course resource library and timely update cutting-edge literature and Chinese and English writing examples; deepen the integration of bilingual teaching and increase content such as intensive reading of international journal papers and English academic communication; strengthen process management and guide students to make full use of micro-platforms and micro-courses for autonomous learning; combine the needs of local chemical industry, introduce practical content such as engineering reports and patent writing, and improve the applicability of the course.

6. Conclusion

Creating "high-quality courses" and eliminating "low-quality courses" is an inevitable requirement for the teaching reform of chemical engineering majors in universities in the new era. The "Four-Micro Integration" teaching system (micro-platform, micro-course, micro-class and micro-communication) constructed by Ms. Zuo Yujing from the School of Chemistry and Chemical Engineering, University of Jinan, relying on interactive new media technology, deeply integrates the new teaching mode into the whole process of teaching design, lesson plan compilation, teacher-student interaction, experiment and internship, building a lightweight teaching mode that can interact anytime and anywhere. It effectively improves classroom teaching quality and students' learning experience, and realizes teaching through fun. The practice with the bilingual course "Chemical Literature Retrieval and Scientific Paper Writing" as the carrier shows that this system can significantly stimulate students' learning interest, improve their professional skills and academic literacy, and provide a feasible path and practical reference for the curriculum reform, "high-quality course" construction and high-quality development of chemical engineering majors in universities.

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