Reform and Practice of Practical Teaching of Applied Undergraduate Courses Based on "Internet +": Taking the Course "Application of Engineering Costing Software" as an Example

Hongmei Wang*, Guangzhen Hou

College of Architecture and Engineering, Chongqing Institute of Engineering, Chongqing 400056, China

*Corresponding author: Hongmei Wang, 807736186@qq.com

Abstract: The reform of teaching methods is the core of classroom revolution. With the rapid advancement of information technology, the technical means are constantly being updated. This study takes the practical course "Engineering Costing Software Application" of engineering costing majors as an example and implements a "classroom revolution" by means of "Internet + education," creating a new mode of teaching and forming a hybrid teaching mode based on "Internet +," which organically integrates online teaching and physical classroom. Through practical exploration, this teaching method can stimulate students' interest in learning; thus, it is worth promoting.

Keywords: Teaching reform; Internet +; Teaching method; Blended teaching

1. Introduction

"Application of Engineering Costing Software" is a compulsory course in undergraduate engineering costing education. In this course, construction projects are taken as the object based on the knowledge of drawing reading, manual measurement, and pricing, and students would learn how to use the Building Information Model (BIM) for construction project measurement and pricing activities. This course is a practical course, which involves practical teaching; thus, professional training rooms, professional software, tools, and other practical conditions are often used for teaching activities. Its teaching content is theoretical but also supplemented by project practice, focusing on developing students' hands-on and project practice abilities. This reflects the training process of developing one's professional skills application ability.

The traditional classroom teaching mode often leads to the separation of teaching and learning between teachers and students [1]. Its areas of teaching and the time for students to practice are limited. These are not conducive to cultivating independent learning and innovation among students. The learning effect is also greatly reduced in this teaching mode, seriously limiting the improvement of teaching quality. With the rapid advancement of information technology such as the internet, mobile communication, and wireless network, a revolution has emerged in higher education classrooms. This revolution focuses on changing the face of the traditional classroom and creating a modern classroom, particularly to establish a new teaching field, a new teaching paradigm, a new learning paradigm, a new teacher-student relationship, and a new teaching environment [2]. Zheng Feng has presented the teaching practice of this classroom revolution

from multiple perspectives, discussing it in a targeted manner from the perspectives of classroom attributes, teacher-student status, and classroom vitality [3]. Liu Zhentian has analyzed the classroom revolution from the perspectives of internal performance and external conditions demanded, proposing that favorable internal and external conditions must be created to provide guarantee and support for the revolution and ensure that the development of this revolution is of high quality [4]. The classroom revolution is a systematic project, which requires the subjects, including universities, teachers, and students, to form coherent cognitions of classroom changes and take common actions for classroom reform, thus gradually changing the teaching of higher education from "teacher-centered" education to cultivating "student-centered" independent learning. This is a shift from "teacher-centered" classroom education to a "student-centered" model that embodies independent learning. Therefore, we have taken into account of the characteristics of today's information technology prior to implementing the "classroom revolution" with the aid of "Internet + education," creating a new model of classroom teaching, and forming a hybrid teaching model based on "Internet +." The new model of online and offline hybrid teaching is based on "Internet +," which organically integrates online teaching with physical classroom to achieve complementary advantages.

2. Existing problems in the practical teaching of the engineering costing course in Chongqing Institute of Engineering

By analyzing the situation at home and abroad as well as the setting and implementation of the practical teaching of the engineering cost professional course in Chongqing Institute of Engineering, it is widely recognized that higher education institutions both at home and abroad emphasize on practical teaching and the cultivation of students' skills. Chongqing Institute of Engineering, as an applied undergraduate university, pays particular attention to the aforementioned aspects. At the same time, higher education institutions at home and abroad are constantly investigating the teaching mode of practical links and carrying out reforms, from which many excellent experiences are worth learning from. However, there are still many problems in the teaching of professional courses in practice.

2.1. Difficulty in achieving a breakthrough in the mode and method of practical teaching of professional courses

In order to improve the effect of practical teaching and realize the purpose of professional skills training, while coping with various practical teaching situations, there is a need to achieve a breakthrough in the mode and method of practical teaching and innovate again.

2.2. Single-manner reflection of practical teaching results of professional courses

One of the main objectives of practical teaching of professional courses is to cultivate a specific professional skill. The acquirement of this professional skill and its quality are reflected in the results of the practical projects that the students have completed. From this, we can see that the form of skill development is too exclusive. Skill development should be evaluated from various aspects, and there should be more variety in the practical teaching result form.

2.3. Professional practice requires specific practice conditions: the fixed nature of practice conditions leads to poor flexibility in practice

Special professional training rooms, professional software (matching encryption locks), professional training bases, *etc*. are prerequisites to carry out practical teaching. Due to the fixed nature of the practice conditions, including the location and the configuration of professional software and encryption locks, the practice lacks flexibility and tends to resist sudden changes. Hence, improving the flexibility of practical teaching and the resistance to sudden changes is a major problem that needs to be solved.

3. Basing on the "Internet +" online and offline hybrid teaching mode

The reform of teaching methods is the core of classroom revolution. In order to cultivate high-quality applied talents, we must explore new paths of reform in this aspect. The development of science and technology and the constant updating of modern technology tools have provided support for the reform of teaching methods. A network classroom with big data, internet of things, artificial intelligence, and mobile internet is an important part of the classroom teaching reform [5]. With the help of the digital practical-training-platform network classroom, a rich teaching resource platform can be built, the teaching content can be updated in real time, excellent resources can be fully utilized, the students' learning situation can be grasped in real time, and the students' learning needs and habits can be accurately analyzed.

Considering the professional, practical, and comprehensive characteristics of this course, the teaching reform was carried out in response to the existing problems in the practical teaching process of the engineering costing course in our school. The course is based on actual engineering projects, with result-oriented teaching design, forming a hybrid teaching mode based on "Internet +." The teaching of the course can be divided into three parts: pre-lesson online learning, in-class instruction and practical exercises, as well as post-lesson consolidation and feedback.

3.1. Pre-lesson online learning

The first is the analysis of the learning situation. The object of teaching is junior undergraduate students of engineering costing, who have completed the study of civil engineering drawing, computer-aided design (CAD), housing architecture, and other courses, with basic knowledge reserve for learning engineering costing software for the first time.

The second is practical teaching conditions. The practice lacks flexibility and tends to resist sudden changes due to the fixed nature of the practice location. Hence, in the practical teaching of this course, special professional training rooms, professional software (supporting encryption lock), *etc.* are needed. Through coordination with the professional software, the lecturer creates a digital practice platform based on the learning mode prior to class so that students can log into the platform using their accounts at any location. This provides flexibility to practical teaching and makes it more resistant to sudden changes.

The third is online pre-study. Using the information-based teaching platform, teachers would upload project drawings, teaching videos, drafting rules, specifications, knowledge points, task books, mind maps of key contents, and other teaching materials in advance to help students in their independent online learning, closely look into the students' participation and pre-study effect through the information-based teaching platform, and conduct random checks on the students' exercises. Process assessment rewards are given to the students, depending on the test results and the completion of independent learning. Under the teachers' supervision and with the assessment mechanism, students' learning enthusiasm and initiative have markedly improved.

3.2. In-class instruction and practical exercises

Firstly, the teacher shows the results of the last lesson and guides the students to observe and identify problems so that they can develop a learning attitude that embodies careful thinking and observation. At the same time, with the help of the information technology teaching platform, students are guided to think actively and take initiative to extract prior knowledge from their knowledge reserves. The topic of each lesson is introduced according to the logical relationship between the building blocks. The teacher composes the teaching content and difficulty levels in advance so that the students would have an overview. Subsequently, the task book is designed in a progressive manner from introductory to intensive and finally to practical difficulty. This makes it easier for students to understand, thus stimulating their enthusiasm for learning. The class is "student-centered," with groups of 5–6 students taking part in software practice

according to the requirements of the task book. The lecturer conducts a walk-through to gauge the progress of students' practical training and mastery of key points. At the same time, students are reminded to record the problems they encounter during the practical exercises and their solutions to them. They are then guided to think in face of the problems and to improve their independent problem-solving skills through internet discussions or on teaching platforms. For key and difficult points and high-frequency error-prone points, teachers demonstrate based on the overall reflection of students to their enhance understanding. At the same time, the integration of curriculum thinking and politics into professional teaching, through the effective integration of the teaching process and specific measures, improves the effectiveness of learning. This integration is conducive to cultivating patriotism and nurturing students into new individuals of the times with both virtue and talent [6].

3.3. Post-lesson consolidation and feedback

After the lesson, students summarize the key points and complete the post-lesson assignments or exercises in the task book. With the aid of the new "ubiquitous" learning environment, such as the information technology platform, Quanlianda services, Zhulong.com, and Civil Engineering Online, further review and consolidation are done. In addition, students are encouraged to take part in subject and skill competitions to promote learning of professional knowledge and the training of operational skills. At the same time, online competitions are organized to achieve in-depth integration with the practical teaching of this professional course through online discipline competitions, which integrate the content of online competitions with practical teaching to realize professional competence training and enrich the form of practical teaching resources and teaching results. The results of online competitions are used as one of the assessment indicators of practical teaching to stimulate students' motivation to consolidate their learning after class.

In order to gain an in-depth understanding of the effectiveness of classroom reform, students' opinions and suggestions concerning the teaching of engineering costing software application are considered. Students can provide feedback through various modalities, such as the telephone, short messaging service (SMS), WeChat, and QQ. It has been proven that in addition to positive outcomes, the degree of participation is higher among students when the questionnaires are shared through the information technology platform and students submit their answers anonymously. There are several open-ended questions in the questionnaires to enable students to have a better understanding of the current teaching methods and to give them the opportunity to to evaluate the current online and offline teaching mode based on "Internet +." Through this, their opinions and suggestions on the reform measures can be taken into account, and thus make improvements in real time to develop a new teaching mode that has good teaching effects and is welcomed by students.

4. Conclusion

With the advent of the information age, "Internet +" is gaining significance in education and teaching. The traditional teaching methods are hardly applicable to contemporary university students. The online and offline teaching mode based on "Internet +" guides students in the independent learning process, stimulates their interest in learning, improves their knowledge acquisition capability, increases their participation in classroom, emphasizes on their initiative, and improves their comprehensive quality and application ability. Moreover, feedback and information on students' learning can be obtained in a multi-level and multi-dimensional manner. In this way, purposeful efforts can be made to obtain excellent teaching results. This would greatly solve the existing problems in practical teaching.

At the same time, in order to adapt to the development of the times and societal changes, capable, high-quality teachers with solid foundation are needed. Along with the current needs of the society for talents,

which require the training of more high-quality applied and specialized personnel, the timely adjustment of the teaching content and the innovation of teaching methods would help stimulate students' initiative and interest for learning. With regard to this course, teachers should also keep up with the development of the times in terms of teaching methods, teaching tools, and teaching management, form collaborations with enterprises, have a good understanding of the dynamics of the industry in real time, and make contributions to the society by cultivating excellent talents who are capable of assuming roles immediately after graduation.

Funding

Disclosure statement

The authors declare no conflict of interest.

References

[1] Qin C, 2019, The Reform of "New Three Teachings" in the Context of Artificial Intelligence Era. China Vocational and Technical Education, 2019(30): 66–68.

[2] Bu D, 2019, The Main Tasks, Priorities, Difficulties and Breakthroughs of the University Classroom Revolution. China Higher Education Research, 2019(6): 1–7.

[3] Zheng F, 2020, Classroom revolution based on the Practice of Teaching Reform. China University Teaching, 2020(10): 17–20.

[4] Liu Z, 2021, Promoting Classroom Revolution in Universities to Achieve High-Quality Development. China Higher Education, 2021(01): 39–40.

[5] Liang Y, Zhang L, 2020, Research on the Informatization Policy of Higher Education in China Based on Discourse Analysis. Journal of Liaoning Normal University (Social Science Edition), 2020(02): 67–73.

[6] Gu Y, Jiang B, Chen D, 2021, The Integration of Inorganic Chemistry Teaching and Civic Science Curriculum. Chemical Engineering and Equipment, 2021(03): 253–254.