Research on the Teaching Reform of Computer Basic Courses for Non-Computer Majors under the Background of New Engineering

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Abstract: Under the background of new engineering education, the teaching of computer basic courses for non-computer major students is confronted with problems such as single content setting, insufficient practical links, and significant differences in student demands, making it difficult to meet the cultivation requirements of interdisciplinary talents for new engineering majors. To meet this demand, this paper proposes teaching reform strategies from aspects such as optimizing the curriculum system, enriching teaching content, increasing experimental class hours, improving teaching methods, and strengthening experimental links, aiming to enhance students' computational thinking and practical ability, and cultivate their computer application ability in a multi-disciplinary intersection environment. Build a flexible curriculum module system, introduce interdisciplinary application cases, establish a cloud-based experimental platform, optimize experimental content and increase extracurricular practical activities to form a multi-level learning and practical training system, providing comprehensive computer skills support for new engineering talents.

Key words: New Engineering；Non-computer major Basic Computer courses；Teaching reform Practical ability

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Introduction

New engineering education aims to cultivate compound talents with interdisciplinary knowledge, innovation ability and engineering practice ability to cope with the rapid changes of modern science and technology and industries. Against this background, computer technology, as a fundamental and general tool, is playing an increasingly important role in various fields such as engineering, science and management. Therefore, the basic computer courses for non-computer major students are an important part of their knowledge structure and a key tool for them to apply technologies and solve complex problems in the professional field. However, at present, the teaching of basic computer courses for non-computer majors still faces many challenges, including the course content being too basic, fewer experimental and practical links, and a single teaching method. It is difficult to effectively cultivate students' computational thinking and interdisciplinary application ability. Therefore, conducting reform research on the current teaching situation of computer basic courses for non-computer majors under the background of new engineering, and exploring more scientific and effective course design and teaching methods, is of great significance for cultivating engineering talents with practical operation ability and innovation ability.

1 The Current Situation and Challenges of Computer Basic Course Teaching for Non-Computer Majors

1.1 The course content does not adequately match the students' needs

Under the background of new engineering, the demand of non-computer major students for basic computer courses gradually shows stronger applicability and interdisciplinarity. However, the current course content leans towards theoretical basis, emphasizing the explanation of basic knowledge, and the depth and breadth of practical application are still insufficient. Although it can help students master basic concepts and programming languages, However, the lack of close connection with practical problems in the new engineering field makes it difficult for the course content to meet students' application needs in real engineering environments. Many non-computer major students expect to master the techniques and methods that can be directly applied to their own disciplines through this course. However, the limitations of the existing courses in terms of content depth and application orientation prevent them from deeply covering the computing skills required in the interdisciplinary field. Especially when it comes to the applications in emerging technological fields such as data analysis, intelligent manufacturing, and the Internet of Things, the course content has not yet been able to support students in conducting in-depth learning and innovative practices in these fields. Therefore, there is a significant matching deviation between the current course content and students' needs, and the application of course design and teaching resources needs to be improved. So as to help students better apply the basic knowledge of computers to specific projects and problem-solving in the fields related to new engineering [1].

1.2 Students' knowledge bases and learning abilities vary greatly

In the teaching of computer basics courses for non-computer majors, there are often obvious differences in students' knowledge levels and learning abilities. Due to students coming from different professional backgrounds, there are significant differences in computer basics. Some students have received programming education during their middle school years and mastered basic programming thinking and operational skills. While some other students have almost no exposure to computer programming and even lack an understanding of the basic concepts of computers. The uneven knowledge base poses a huge challenge to the teaching design, making it difficult for the unified teaching content to meet the actual learning needs of all students. If the teaching content leans towards basic knowledge, students who progress faster will find the course content too simple and lack challenge. However, if the course content is set too deeply, it will make it difficult for some students to keep up with the learning pace, causing them to feel frustrated or even lose interest in learning. Facing this situation, teachers need to pay attention to the learning characteristics and ability levels of different students in teaching, and try to balance the teaching content in depth and breadth. The lack of effective hierarchical teaching methods and differentiated learning support in the curriculum limits the satisfaction of students' individualized learning needs. Students of different ability levels find it difficult to achieve ideal learning outcomes in a unified curriculum [2].

1.3 Limitations of the traditional teaching mode

In the computer basic courses of non-computer majors, the main way of the traditional teaching mode is concentrated on classroom lectures, emphasizing the conveyance of theoretical knowledge, but often ignoring the actual needs of students for the application of knowledge. Teachers mostly adopt the one-way knowledge indoctrination mode in the teaching process. In the classroom, theory is the main focus, explaining the concepts and basic principles of computers, but the practical links are relatively lacking. It makes it difficult for students to carry out hands-on operations and attempts during the learning process. Due to the lack of integration between the explanation of course content and real application scenarios, students find it difficult to feel the practical value and application prospects of computer knowledge in class. As a result, their interest and initiative are restricted. Insufficient interaction is also a prominent problem in the traditional teaching mode. Relying solely on the content taught by teachers, students' participation in class is relatively low and there are few opportunities for interaction. Students' questions and thoughts cannot be promptly responded to, and the learning atmosphere often makes it difficult for them to generate the motivation for in-depth thinking and exploration when facing new knowledge. The traditional model also limits students' opportunities for cooperative learning, making it difficult for them to solve problems, share ideas and experiences through collaboration. As a result, the curriculum lacks vividness and flexibility, and students' innovative consciousness and practical problem-solving abilities are also hard to be cultivated and enhanced in the classroom [3].

1.4 Insufficient practical and experimental resources

The practical and experimental resources in the basic computer courses for non-computer majors are insufficient, making it difficult for students to systematically master computer application skills in experiments. The experimental links are often set up without a coherent learning system, and the experimental contents are mostly limited to simple operations and basic knowledge verification, unable to effectively combine with engineering practice and complex application scenarios. Fragmented and monotonous experimental content is difficult to help students understand the practical application value of knowledge in practice, nor can it cultivate their ability to solve practical problems. Some experimental equipment is outdated and the resource allocation is limited, which cannot meet the needs of students for in-depth learning and conducting exploratory experiments. The experimental operation steps are often simple and repetitive. Students lack space for self-exploration and analysis, and the connection between the experimental content and classroom knowledge is not close enough. This makes it difficult for students to consolidate and expand the theoretical knowledge they have learned in experiments and prevent them from experiencing the practical application of computer skills in practice. The lack of practical resources also makes it difficult for students to carry out autonomous learning and extended experiments after class. The depth and breadth of the experiments are limited, and the learning effect is hard to be strengthened. As a result, students often fail to master the basic skills of computer application after the experimental classes, and their enthusiasm for the practical links is also affected [4]

2 Teaching Reform Strategies for Computer Foundation Courses in Non-Computer Majors under the Background of New Engineering

2.1 Clarify teaching objectives and emphasize application orientation

Under the background of new engineering, the teaching reform of the basic computer courses for non-computer majors needs to clarify the teaching objectives first and emphasize the application orientation. The current educational background requires that computer courses are not only the imparting of knowledge, but also the cultivation of students' ability to flexibly apply computer skills in interdisciplinary fields. To meet this requirement, the curriculum design should focus on enhancing students' computational thinking as the core, concentrate on shaping practical application abilities, and enable students to effectively apply computer tools and methods to solve problems when facing specific disciplinary demands. Computational thinking can help students understand the logical structure of programming and also encourage them to use computers to solve complex real-world problems. This is particularly important in the multi-disciplinary cross-application of new engineering disciplines. Therefore, teaching content should closely revolve around application scenarios, with a focus on modules closely related to various disciplines such as data processing, modeling and simulation, and basic programming. Introducing practical cases in the classroom and explaining them in combination with engineering problems enables students to gradually experience the wide application of computer skills in their respective professional fields. Application-oriented teaching also needs to strengthen the experimental links and project task design in the course, encourage students to independently explore and practice hands-on in the learning process, deepen their understanding of knowledge, and form the awareness of actively solving problems. Train students' thinking habits and problem-solving abilities through real application scenarios, enabling them to possess solid computer application skills in future engineering practices, and laying a solid foundation for cultivating compound talents with both computational thinking and interdisciplinary innovation capabilities in new engineering education.

2.2 Optimize the curriculum system

Under the background of new engineering, optimizing the basic computer curriculum system for non-computer majors requires improvements in aspects such as curriculum setting, teaching content and experimental links, in order to cultivate students' computational thinking and practical abilities in different majors. First of all, improving the curriculum design is the foundation for achieving teaching effectiveness. The course content should be modularly designed based on the actual needs of each major, and learning modules should be set up at different levels, allowing students to choose the depth and breadth of courses suitable for their own majors. The modular setting can take into account both the basic and professional aspects, ensuring that students can apply the computer knowledge they have learned in their respective disciplinary backgrounds. Secondly, enrich the teaching content. By increasing the number of interdisciplinary practical application cases, students can see the practical value of computer technology in various fields. The courses cover diverse applications from data analysis to engineering design, and combine interdisciplinary contents such as economic management, medical health, and environmental science, allowing students to better understand the importance of computer technology in real scenarios. In this way, students can not only master basic calculation skills during the learning process, but also cultivate the comprehensive ability to solve complex problems. Finally, increase the proportion of experimental class hours and strengthen practical teaching to enable students to deeply understand the application of computer concepts and skills in operations. The experimental tasks designed in the practical links should cover core contents such as programming, algorithms, and data processing. Encourage students to analyze problems, independently debug programs, and optimize solutions in hands-on operations. The intensification of the experimental section provides students with more hands-on opportunities, enabling them to transform theoretical knowledge into practical application abilities in practice. This makes their mastery of computer knowledge more in-depth and systematic, laying a solid foundation for future interdisciplinary engineering practices [5].

2.3 Improve teaching methods and enhance interactivity

In the teaching reform of the basic computer course, improving teaching methods and enhancing classroom interactivity are the keys. Project-driven teaching, as a task-oriented teaching method, integrates knowledge points into specific projects and stimulates students' learning interest and exploration desire by setting challenging tasks. During the process of completing the project, students need to actively collect information, analyze problems and design plans. In this process, they improve their practical ability and also enhance their mastery of knowledge. The flipped classroom model shifts the knowledge imparting of the traditional classroom to before class. Students complete the study of self-study videos, documents and other materials before class, and the class time is used for solving practical problems, discussions and hands-on operations. Under this arrangement, students become the dominant force in the classroom, and the teaching activities change from passive acceptance to active participation, significantly improving the learning effect. Online resources and experimental platforms provide students with more diversified learning support. By using these platforms, teachers can create a rich variety of online experiments, simulation operations and programming exercises, allowing students to practice what they have learned at any place and any time. This not only makes up for the lack of class time, but also provides immediate feedback. Enable students to identify problems during the self-study process and solve them in a timely manner. Diverse teaching methods offer students a more flexible learning path, allowing them to choose the appropriate learning approach based on their personal progress and interests, truly meeting the personalized learning needs of students at different levels. The combination of diverse teaching methods such as project-driven, flipped classrooms, and online resources has enhanced classroom interactivity and greatly stimulated students' initiative, making the learning process more attractive and effective.

2.4 Introduce artificial intelligence technology to enhance the intelligent level of teaching

The introduction of artificial intelligence technology provides brand-new ideas and means for the teaching reform of computer basic courses in non-computer majors. Artificial intelligence realizes intelligent teaching assistance through personalized learning platforms. For instance, teachers can utilize AI-driven learning systems to analyze students' learning behaviors, record their learning progress, homework completion, and test results, and generate personalized learning paths and feedback reports for each student. The system automatically recommends learning resources based on students' strengths and weaknesses, such as programming exercises, algorithm examples, or interdisciplinary cases suitable for their levels. So as to meet the needs of students at different learning levels.

Artificial intelligence can enrich the ways of classroom interaction. For instance, applying AI chatbots or virtual teaching assistants in the classroom can help students quickly answer programming-related questions or guide them to complete practical tasks. Ai-driven real-time code inspection and debugging tools can assist students in promptly identifying and correcting programming errors during the experimental stage, significantly enhancing learning efficiency. AI technology can also provide more innovative teaching content for the classroom, such as introducing artificial intelligence application cases, allowing students to understand the practical applications of AI in fields like autonomous driving, intelligent manufacturing, and medical health, thereby enhancing the practicality and interest of learning. AI technology can also play a significant role in course evaluation. By automatically assessing students' programming works through AI systems, the logic and execution efficiency of the programs can be analyzed, and suggestions for improvement on code quality and innovation can also be put forward. The combination of AI and traditional teaching methods significantly enhances the effectiveness of classroom teaching and the quality of practical links, comprehensively cultivates students' computational thinking and technical application abilities, and helps non-computer major students adapt to the future multi-disciplinary intersection demands in the context of new engineering.

3 Conclusion

Under the requirements of new engineering education, reforming the basic computer courses for non-computer majors is not only an effective way to enhance students' computational thinking and practical ability, but also a necessary measure to cultivate interdisciplinary innovative talents. Optimizing the curriculum system, introducing practical application cases, increasing experimental class hours and building flexible experimental platforms It provides students with comprehensive and in-depth learning and practical opportunities, enabling them to proficiently apply computer skills to solve practical problems in various disciplinary scenarios. The multi-level teaching mode enhances students' understanding of computer technology, and also stimulates their spirit of exploration and innovation ability, laying a solid foundation for them in the ever-changing engineering practice in the future.

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