

Research on the reform of C language programming teaching based on the training of new engineering talents

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Abstract: With the rapid development of information technology, C language, as a traditional and important programming language, plays an increasingly prominent role in the cultivation of new engineering talents. This paper focuses on the teaching of C language programming, exploring how to combine the concept of new engineering education to enhance students' programming abilities and innovation consciousness through teaching reform. The paper first analyzes the importance of C language in the cultivation of new engineering talents, then proposes reform suggestions from aspects such as curriculum design, teaching methods, and practical activities. The effectiveness of the reform measures is verified through case studies and survey research. The study shows that the teaching reform of C language programming based on the cultivation of new engineering talents can effectively stimulate students' interest in learning, enhance their programming abilities and innovative thinking, thus better adapting to the development needs of the information age.

1. Introduction

In the context of the rapid development of information technology today, computer programming has become one of the core skills necessary for new engineering talents. As a classic and important programming language, C language plays an irreplaceable role in the cultivation of new engineering talents. The quality and effectiveness of C language programming teaching are directly related to the cultivation of students' programming abilities and innovation consciousness. Therefore, it is particularly urgent to reform and explore C language programming teaching to meet the needs of the new era talent cultivation. This paper aims to conduct in-depth research on the theme of "Teaching Reform of C Language Programming Based on the Cultivation of New Engineering Talents". Firstly, it will sort out and elaborate on the concept of new engineering education, clarifying its guiding significance for C language programming teaching. Then, it will analyze the status and role of C language in the cultivation of new engineering talents, as well as the problems and challenges existing in the current traditional teaching mode. Based on this, reform strategies for C language programming teaching based on the concept of new engineering education will be proposed, including measures such as curriculum adjustment, teaching method innovation, and strengthening of practical activities. The effectiveness and practical effects of the teaching reform

plan will be verified through case studies and survey research. Through this research, the aim is to provide theoretical support and practical guidance for the reform of C language programming teaching, promote continuous innovation and improvement of the new engineering education mode, and contribute to the cultivation of outstanding talents with innovative spirit and practical ability.

2. New Engineering Talent Cultivation and C Language Programming Teaching

2.1. The Concept of New Engineering Talent Cultivation

The concept of new engineering talent cultivation originates from a profound understanding of the development needs of contemporary society and industry, aiming to cultivate high-quality engineering and technical talents adaptable to the rapid changes and application demands of information technology. Its core features include interdisciplinary comprehensive abilities, innovation and entrepreneurship capabilities, practical abilities, and teamwork spirit, etc. In the concept of new engineering talent cultivation, the emphasis is no longer solely on the imparting of traditional disciplinary knowledge, but more on cultivating students' practical operation abilities, problem-solving abilities, and innovation consciousness. Firstly, new engineering talent cultivation emphasizes interdisciplinary comprehensive abilities. With the development of science and technology and the expansion of application fields, engineering and technical talents need to possess interdisciplinary knowledge and abilities, be able to flexibly apply them in multiple fields, and solve complex problems. Therefore, new engineering talent cultivation emphasizes breaking the boundaries between disciplines, encouraging students to learn interdisciplinary and integrate knowledge. Secondly, new engineering talent cultivation emphasizes innovation and entrepreneurship capabilities. In the current highly competitive social environment, innovation has become an important driving force for social progress and economic development. Therefore, new engineering talent cultivation focuses on cultivating students' innovation consciousness and innovative abilities, encouraging them to explore and innovate, and cultivating high-quality talents with innovative spirit. In addition, new engineering talent cultivation also emphasizes practical abilities and teamwork spirit. Through practical teaching and project practices, students' hands-on abilities and abilities to solve practical problems are cultivated; at the same time, cooperation among students is advocated to cultivate their teamwork spirit and communication abilities, enabling them to better adapt to future work and social life needs. In summary, the concept of new engineering talent cultivation emphasizes the comprehensive cultivation of talents, focuses on cultivating students' practical abilities, innovative spirit, and teamwork spirit, aiming to cultivate high-quality engineering and technical talents adaptable to the needs of the times and internationally competitive. Integrating the concept of new engineering talent cultivation into C language programming teaching can help enhance students' comprehensive abilities and innovation consciousness, promote them to become more outstanding engineering and technical talents. Therefore, in the cultivation of new engineering talents, C language programming teaching should be valued and strengthened [1].

2.2. The Status and Role of C Language Programming in the Cultivation of New Engineering Talents

C language, as a classic and widely used programming language, plays an important role in the cultivation of new engineering talents. Its status and role are mainly reflected in the following aspects: Firstly, C language is the foundation of computer programming. In the process of learning computer programming, C language is often used as the entry language for teaching. Mastering the basic syntax, data structures, and algorithms of C language helps students establish a solid

programming mindset and logical analysis ability, laying a solid foundation for future learning of other programming languages. Secondly, C language is widely used in system software and embedded development fields. With the continuous development of information technology, the demand for system software and embedded systems is growing, and C language is one of the most commonly used programming languages in these fields. Therefore, mastering C language programming skills can lay the foundation for students' future work in related fields. Furthermore, C language is efficient and flexible. Compared with other high-level programming languages, C language has high execution efficiency, fast running speed, and strong low-level operation capabilities. It can directly manipulate memory, which performs well in some application scenarios with high performance requirements. Learning C language not only helps students understand the underlying principles of computers but also cultivates their ability to solve complex problems. Finally, learning C language helps cultivate students' abstract thinking and problem-solving abilities. In the process of C language programming, students need to use abstract thinking to transform concrete problems into program design, which cultivates their abstract thinking ability; at the same time, solving programming problems requires students to constantly analyze, debug, and optimize the code, thereby cultivating their problem-solving ability. In summary, C language plays an irreplaceable role in the cultivation of new engineering talents. Through learning C language, students can not only establish a solid programming foundation but also cultivate problem-solving abilities and innovative spirit, thus better adapting to the development needs of future society. Therefore, in the cultivation of new engineering talents, C language programming teaching should be valued and strengthened.

3. C Language Programming Teaching Status Analysis

3.1. Characteristics of Traditional C Language Programming Teaching Mode

The traditional C language programming teaching mode typically exhibits the following characteristics: **Emphasis on theoretical knowledge impartation:** The traditional teaching mode primarily relies on classroom lectures, focusing on imparting theoretical knowledge of C language, including basic syntax, data types, control structures, and so forth. Teachers usually convey knowledge to students through explanation and demonstration, with students' main task being knowledge acquisition. **Emphasis on programming skills and algorithms:** Besides theoretical knowledge, the traditional teaching mode also emphasizes fostering students' programming skills and algorithmic abilities. Teachers often design simple programming exercises or small projects for students to practice hands-on and emphasize teaching common programming techniques and algorithmic concepts. **Lack of practical sessions and project practice:** The traditional teaching mode often lacks practical sessions and project practices. Students mainly grasp knowledge through classroom learning and post-class exercises, lacking the ability to solve real-world problems and project practice experience. **Singular teaching methods and evaluation systems:** Traditional teaching modes typically adopt singular teaching methods such as lectures, exercises, exams, etc., with evaluation systems primarily focusing on exam scores, lacking comprehensive evaluation of students' actual abilities and innovative potential. **Low student engagement:** Due to the emphasis on theoretical knowledge impartation and the leading role of teachers in the traditional teaching mode, students' participation in the classroom is low, lacking initiative and creativity, leading to limited learning outcomes. In conclusion, although the traditional C language programming teaching mode can to some extent meet students' basic knowledge acquisition needs, it lacks in cultivating students' practical operational abilities, problem-solving skills, and innovative consciousness. Therefore, it is necessary to reform and innovate the traditional teaching mode, combine the concepts and requirements of new engineering education, explore more effective teaching methods and

evaluation systems, and enhance teaching quality and effectiveness.

3.2. Analysis of Existing Problems and Challenges

Under the traditional C language programming teaching mode, there are several problems and challenges, mainly including the following aspects: Theoretical detachment from practice: The traditional teaching mode emphasizes the impartation of theoretical knowledge but often neglects its integration with practical engineering applications. The knowledge learned by students often remains confined to textbooks, lacking application abilities for real-world problems, making it difficult to effectively translate acquired knowledge into solutions for actual projects. Low student engagement: Since the traditional teaching mode is teacher-led, students' participation in the classroom is low, lacking enthusiasm and proactiveness. Students are often passive recipients of knowledge, lacking independent thinking and the cultivation of innovative abilities. Lack of practical opportunities: The traditional teaching mode lacks sufficient practical sessions and project practice opportunities. The knowledge acquired by students in the classroom often proves challenging to apply to actual projects, resulting in a lack of experience in solving real engineering problems and practical abilities. Singular teaching methods: In the traditional teaching mode, teaching methods are relatively singular, primarily focusing on lectures and exercises, lacking diversified teaching tools and methods. This teaching approach struggles to stimulate students' interest and potential for learning, resulting in poor teaching effectiveness. Incomplete evaluation system: In the traditional teaching mode, the evaluation system mainly relies on exam scores, overlooking the evaluation of students' actual abilities and innovative potential. This evaluation method fails to comprehensively reflect students' learning situations and levels of ability, leading to a disconnect between learning objectives and evaluation criteria. In summary, the traditional C language programming teaching mode faces numerous problems and challenges, necessitating teaching reforms and innovations. Against the backdrop of new engineering education, it is essential to adjust teaching content and methods, increase practical sessions and project practice opportunities, establish a diversified evaluation system, and ultimately enhance teaching quality and effectiveness while cultivating students' practical operational abilities, problem-solving skills, and innovative consciousness [2].

4. Reform Strategies for C Language Programming Teaching Based on the Cultivation of New Engineering Talents

4.1. Curriculum Design and Teaching Content Adjustment

In the reform of C language programming teaching, comprehensive adjustments and optimizations to curriculum design and teaching content are crucial. Firstly, it is imperative to re-examine the course objectives to ensure alignment with the philosophy of cultivating new engineering talents. Besides imparting basic syntax and data structures of C language, we should prioritize nurturing students' programming thinking, problem-solving abilities, teamwork spirit, and innovation consciousness. This implies the need to liberate students from passive knowledge acquisition and stimulate their desire for active learning. Secondly, optimizing teaching content to align more closely with real-world application scenarios is essential. In addition to theoretical knowledge, emphasis should be placed on cultivating students' practical programming skills and hands-on operational abilities. By introducing case studies and real programming challenges relevant to actual projects, students can gradually enhance their programming skills while solving real problems. Such a learning approach not only makes the process more engaging but also strengthens students' understanding and retention of learned knowledge. Furthermore, introducing

project-based activities where students engage in project development within a teamwork environment is essential. Through such practical activities, students not only enhance their practical operational capabilities but also develop teamwork and communication skills. This is crucial for their future career development, as teamwork is an indispensable quality in real-world work environments where projects are rarely completed by individuals alone. Additionally, strengthening laboratory sessions by designing challenging and practical tasks allows students to practice hands-on and improve their problem-solving abilities and practical experience. Moreover, incorporating innovative teaching content, introducing new programming technologies and tools, and exploring cutting-edge programming concepts and methods can stimulate students' innovative consciousness and thirst for knowledge. Through these adjustments and optimizations, the C language programming course can better meet the requirements of cultivating new engineering talents, providing students with a richer learning experience, and better nurturing their programming skills, innovation consciousness, and teamwork spirit[3].

4.2. Innovation in Teaching Methods and Updating Teaching Tools

Addressing the challenges of traditional C language programming teaching modes requires innovative teaching methods and updated teaching tools. Firstly, introducing project-driven teaching methods, where students design and implement real projects, allows them to master C language programming skills through practical experience, leading to a deeper understanding of knowledge and the development of practical problem-solving abilities. Secondly, adopting problem-oriented learning approaches, placing students in problem situations, stimulates their curiosity and motivation to solve problems. Through independent learning and collaborative discussions, students' autonomy and teamwork abilities are cultivated. Additionally, inquiry-based learning is an effective teaching method, fostering students' critical thinking and innovative consciousness through autonomous exploration and discovery of knowledge. During the teaching process, interactive teaching methods can be employed to promote communication between teachers and students and collaboration among students, enhancing teaching effectiveness. Furthermore, utilizing multimedia technology to assist teaching by designing vivid and interesting teaching resources such as instructional videos and interactive courseware enhances students' interest and engagement in learning. Finally, implementing personalized learning modes, tailored to students' learning characteristics and needs, provides individualized learning support and guidance, allowing each student to find their own learning methods and pace. Through the innovation of these teaching methods and the updating of teaching tools, C language programming teaching can better meet students' learning needs and real-world application scenarios, thereby enhancing teaching effectiveness and student motivation.

4.3. Strengthening Practical Components and Introducing Project-Driven Teaching

To address the lack of practical experience in traditional C language programming teaching, it is necessary to strengthen practical components and introduce project-driven teaching methods. Firstly, enhancing practical components can be achieved by increasing the quantity and quality of laboratory sessions. In these sessions, students can write code, debug programs, and solve real-world problems, consolidating their knowledge and improving their programming skills and practical abilities. Additionally, designing challenging and practical lab tasks enables students to master various programming techniques and problem-solving methods through hands-on practice. Secondly, introducing project-driven teaching methods, where projects serve as the primary learning vehicle, allows students to learn and apply C language programming knowledge within real-world scenarios. In project practice, students engage in activities such as requirement analysis,

system design, coding, testing, and debugging, comprehensively enhancing their problem-solving abilities and teamwork spirit. Project-driven teaching not only allows students to apply their learning but also enhances their practical skills and innovative consciousness. During the process of strengthening practical components and introducing project-driven teaching, instructors should play a guiding role by providing necessary support and guidance to students while encouraging them to explore and practice independently. Through practical activities and project practices, students will gain a deeper understanding of the principles and applications of C language programming, improving their practical abilities and problem-solving skills, laying a solid foundation for their future work and study. Therefore, the reinforcement of practical components and the introduction of project-driven teaching are of significant importance for improving the quality and effectiveness of C language programming teaching.

5. Implementation and Evaluation of Teaching Reform

5.1. Description of Teaching Reform Scheme Design and Implementation Process

The design and implementation of teaching reform schemes constitute a comprehensive endeavor that requires meticulous planning and orderly execution. Initially, the teaching team conducts in-depth analysis of the current traditional C language programming teaching mode, conducts extensive needs surveys and background investigations to fully understand the expectations and requirements of students, teachers, and businesses regarding teaching content, methods, and outcomes, thereby establishing the goals and direction of teaching reform. Subsequently, based on the needs analysis, the teaching team formulates specific reform plans, including setting teaching objectives, adjusting teaching content, innovating teaching methods, updating teaching tools, etc., and clarifies implementation steps and timelines. To support the implementation of the reform plan, the school and relevant departments need to provide adequate resources and support, including textbooks, equipment, laboratory environments, etc., and organize related teacher training and guidance activities to help teachers grasp new teaching concepts, methods, and techniques. During the implementation phase, the teaching team will advance the implementation of various reform measures according to the plan, establish effective monitoring and evaluation mechanisms to track and evaluate the reform effects, promptly identify problems, and make adjustments and optimizations. Finally, through experience summary and continuous improvement, the teaching team will summarize successful experiences and lessons learned, continuously optimize the reform plan, and improve teaching quality and effectiveness. Such a series of orderly and systematic steps will ensure the smooth implementation of the teaching reform plan and make positive contributions to the comprehensive improvement of students' qualities and the cultivation of new engineering talents[4].

5.2. Evaluation Indicators and Methods for Teaching Effectiveness

To comprehensively evaluate the implementation effects of teaching reform schemes, it is necessary to establish a scientifically sound evaluation system and adopt various methods for evaluation. Firstly, we will focus on students' academic performance, including classroom performance, completion of assignments, exam scores, etc., as these data objectively reflect the extent to which students have mastered the knowledge and improved their learning abilities. Secondly, we will emphasize the assessment of students' practical abilities, evaluating their skills and problem-solving abilities in practical operations through project results, the quality of experiment reports, etc. At the same time, we will collect students' feedback through methods such as questionnaire surveys, group discussions, etc., to understand their satisfaction and opinions on

teaching content, methods, and teaching quality. Additionally, we will evaluate the teaching quality of teachers, including teaching effectiveness, teaching attitude, teaching methods, etc., to assess teachers' performance and contributions to teaching reform. Finally, we will also pay attention to students' employment situations, evaluating the impact of teaching reform on students' career development through factors such as the employment status of graduates and job matching. By combining quantitative and qualitative evaluations, as well as the comprehensive use of methods such as questionnaire surveys, student work displays, expert reviews, and tracking surveys, we will be able to comprehensively and objectively evaluate the effectiveness of teaching reform schemes, providing strong references and guidance for future teaching work.

5.3. Analysis and Discussion of the Practical Effects of Teaching Reform

After a period of teaching reform implementation, it is necessary to conduct in-depth analysis and discussion of its practical effects to understand the effectiveness of the reform and identify existing problems, thereby proposing further improvement suggestions. Firstly, we will analyze the actual effects on students' academic performance, practical abilities, and employment situations. By comparing data such as average grades and excellence rates before and after the reform, we can preliminarily evaluate the impact of teaching reform on students' academic performance. Additionally, observing students' performance in practical projects and the quality of experiment reports can assess the improvement of students' practical abilities through teaching reform. Moreover, through graduates' employment situations and job matching, we can initially understand the impact of teaching reform on students' career development. Secondly, we need to analyze the actual effects on the teaching quality and effectiveness of teachers. By observing teachers' teaching attitudes, methods, and effectiveness, as well as listening to students' feedback, we can evaluate teachers' performance and contributions to teaching reform, thereby providing references for further training and improvement of teachers. Finally, we need to conduct comprehensive analysis and discussion of the actual effects of teaching reform schemes, identify the achievements and problems of the reform, and propose further improvement suggestions. Through the analysis and discussion of actual effects, we can deeply understand the actual situation of teaching reform, identify problems, and timely adjust and optimize teaching reform schemes to continuously improve teaching quality and effectiveness, making greater efforts and contributions to the comprehensive improvement of students' qualities and the cultivation of new engineering talents[5].

6. Conclusion

In the implementation process of teaching reform schemes, adjustments and optimizations to the C language programming teaching mode have been made to meet the needs of cultivating new engineering talents. Through measures such as introducing project-driven teaching, strengthening practical components, updating teaching tools and evaluation methods, some achievements have been made. Firstly, students' academic performance has improved, their practical abilities have been effectively cultivated, and there has been a positive trend in employment situations. Secondly, the teaching quality and effectiveness of teachers have also improved, and the professional quality of the teaching team has been enhanced. However, teaching reform still faces challenges and problems, such as insufficient teaching resources and low student interest. Therefore, in future teaching work, we need to further strengthen the construction of teaching resources, stimulate students' interest in learning, continuously improve teaching methods and tools, and continuously improve the evaluation system to enhance teaching quality, making greater efforts and contributions to the comprehensive improvement of students' qualities and the cultivation of new engineering talents.

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