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Analysis on the Teaching Reform of Microcomputer Principle and Single Chip Microcomputer Interface Technology Course

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Abstract: Microcomputer Principle and Single Chip Microcomputer Interface Technology is a core compulsory course for engineering majors in electronic information and related fields in universities. It focuses on teaching professional knowledge such as single-chip microcomputer control programming, application, and design of complex control systems, which is conducive to improving students' innovation ability, practical ability, and complex engineering processing ability. Based on the background of the new era, this paper analyzes the key points of teaching reform in the Microcomputer Principle and Single Chip Microcomputer Technology course, examines the current teaching status of the course, and proposes to actively promote the construction of ideological and political education in the course, use virtual simulation technology to carry out experimental teaching, implement online and offline blended teaching, build an integrated teaching mode of theory and practice, and improve the teaching evaluation system, to comprehensively enhance the teaching quality of the Microcomputer Principle and Single Chip Microcomputer Technology course.

Keywords: Microcomputer Principle and Single Chip Microcomputer Technology; Electronic information; Teaching status; Reform paths

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1. Introduction

In the era of artificial intelligence, electronic information technology is increasingly applied in various industries, driving the growth in demand for talents in electronic information engineering, intelligent equipment, and other fields. The Microcomputer Principle and Single Chip Microcomputer Technology course, as a core course for electronic information engineering, electrical automation, and other majors, should actively align with industrial development and optimize talent training programs to improve the quality of engineering talent training. However, the current teaching of the Microcomputer Principle and Single Chip Microcomputer Technology course faces issues such as monotonous teaching methods, inadequate infiltration of ideological and political

education, and a disconnect between theory and practical teaching, which affect the quality of course teaching. Based on this, universities should actively promote the reform of the Microcomputer Principle and Single Chip Microcomputer Technology course, advance the construction of ideological and political education and the integration of theory and practice in teaching, innovate teaching content and methods, stimulate students' interest in learning, guide them to actively explore professional knowledge in microcomputer system programming and system design, motivate them to actively engage in scientific research and entrepreneurship, and improve the quality of the course and education.

2. The teaching focus of the "Microcomputer Principles and Single Chip Microcomputer Technology" course in colleges and universities under the background of new era

2.1. Implementing the fundamental task of cultivating people with virtue

Colleges and universities shoulder the heavy responsibility of cultivating high-quality, innovative, and cutting-edge talent. It is imperative to not only excel in professional teaching but also enhance students' scientific research spirit, patriotism, and craftsmanship. They should inspire students to emulate the indifference to fame and fortune, dedication, problem-solving prowess, and patriotic sentiments of Chinese researchers. Furthermore, students should be encouraged to establish lofty aspirations to serve the motherland, thereby nurturing more outstanding young talents for the country [1]. As a compulsory course for electronics information and intelligent manufacturing majors in colleges and universities, "Microcomputer Principles and Single Chip Microcomputer Technology" should actively promote the construction of ideological and political education in the curriculum, facilitating the integration of professional knowledge with ideological and political education. This allows students to receive ideological and political education while learning the course, cultivating their patriotism, scientific research spirit, and innovative spirit. In this way, the fundamental task of cultivating people with virtue is implemented, and the advantages of curriculum education are leveraged.

2.2. Advancing engineering education professional accreditation

In 2016, China officially became a member of the Washington Accord, marking the international equivalence of China's engineering education quality certification system and the international recognition of China's engineering professional quality standards. The teaching of the "Microcomputer Principles and Single Chip Microcomputer Technology" course should be based on the background of engineering education professional accreditation, actively align with the world, introduce teaching models from prestigious foreign universities in electronic information engineering, optimize curriculum standards and teaching models, and further enhance students' innovative capabilities, abilities to solve complex engineering problems, and their work ethic. This, in turn, promotes reforms in engineering education, aims to build world-class electronic information engineering programs, and enhances China's international influence in engineering education [2].

2.3. Advancing the construction of emerging engineering disciplines

With the rapid development of China's intelligent manufacturing industry, the demand for emerging engineering talents with engineering practical abilities and innovative capabilities continues to grow. Based on this, colleges and universities should actively promote the construction of emerging engineering disciplines and accelerate reforms in engineering majors such as electronic information, intelligent equipment, and mechanical automation

to cultivate "excellent engineers" [3]. Colleges and universities should advance reforms in the teaching of the "Microcomputer Principles and Single Chip Microcomputer Technology" course, facilitate interdisciplinary integration, empower classroom teaching with artificial intelligence, employ virtual simulation technology for experimental teaching, and implement online and offline blended teaching. This approach guides students in engaging in interdisciplinary studies, thereby enhancing their comprehensive abilities and facilitating their growth into compound engineering talents, laying a solid foundation for their future employment.

3. Analysis of the current teaching situation of the course "Microcomputer Principles and Single-chip Microcomputer Technology"

3.1. Rigid integration of ideological and political elements with knowledge points

In the context of fostering talent with virtue, teachers of the course "Microcomputer Principles and Single-chip Microcomputer Technology" in colleges and universities are actively infiltrating ideological and political education. However, due to inadequate ideological and political education capabilities, the exploration of ideological and political elements in textbooks is not comprehensive or in-depth. Mostly, the focus is on the scientific research spirit, while patriotic and craftsmanship spirits are only briefly mentioned, which affects the quality of ideological and political teaching in the course. Some teachers have not clarified the relationship between ideological and political elements and knowledge points, resulting in a rigid integration of the two, which is difficult to stimulate students' emotional resonance and is not conducive to the improvement of their moral quality [4].

3.2. Loose connection between theoretical and practical teaching

"Microcomputer Principles and Single-chip Microcomputer Technology" is a course that emphasizes both theory and practice, with high requirements for students' professional knowledge reserve and hands-on operational abilities [5]. However, current course teaching exhibits a problem of "emphasizing theory over practice," with a disconnection between theory and practical teaching. It mainly focuses on basic experiments that come with textbooks and lacks comprehensive and design-oriented experiments, making it difficult to guide students in interdisciplinary and deep learning, which hinders their professional development. Additionally, some teachers neglect the introduction of typical industrial cases, resulting in practical teaching content lagging behind industrial development, which is not conducive to cultivating students' professional knowledge application abilities and engineering practice abilities.

3.3. Single mode of informationized teaching

In the era of artificial intelligence, smart teaching reforms in colleges and universities are carried out in full swing. However, the informationized teaching effect of "Microcomputer Principles and Single-chip Microcomputer Technology" is not ideal. For example, many teachers have conservative teaching concepts and are more accustomed to using PPT and micro-lectures for teaching, rarely utilizing virtual simulation technology for experimental teaching. This makes it difficult to monitor students' microcomputer system design and single-chip microcomputer interfacing processes in real-time, affecting the quality of experimental teaching [6]. Some teachers' mixed teaching designs are not very reasonable, and they are busy designing online teaching links but fail to properly connect online and offline teaching. They do not conduct comprehensive analysis of online data, making it difficult to carry out offline, precise teaching, which results in unsatisfactory mixed teaching quality.

3.4. Imperfect teaching evaluation system

Currently, the teaching evaluation of the course "Microcomputer Principles and Single-chip Microcomputer Technology" in colleges and universities focuses on summative evaluation, with more emphasis on students' final written exams and experimental exam scores, combined with their attendance rates and homework quality. There is a lack of formative evaluation, such as the evaluation of students' online learning processes and industrial internship processes, which makes it difficult to promptly identify issues in teaching and student learning. In addition, the teaching evaluation subject is only the teacher, neglecting to invite industry experts to participate in teaching evaluation and not collecting students' evaluations of course teaching, which affects the promotion of course teaching reform [7].

4. The teaching reform paths of the course "Microcomputer Principles and Single Chip Microcomputer Technology"

4.1. Promote ideological and political education in courses to cultivate students' moral sentiments

Teachers should actively explore the ideological and political elements contained in the textbook of "Microcomputer Principles and Single Chip Microcomputer Technology," clarify the connection points between professional knowledge and ideological and political elements, and subtly infiltrate ideological and political education to improve students' moral qualities. For example, when teaching "ARM Architecture and Applications," teachers can enumerate application cases of ARM architecture in the Internet of Things and mobile devices, highlighting the advantages of low power consumption and high efficiency of ARM architecture to stimulate students' interest in learning. Firstly, teachers can play AIoT short videos of Tmall Genie to show China's achievements in smart home research and development, infiltrating patriotism education, inspiring students to learn from the patriotic spirit of Chinese researchers who are innovative, self-reliant, and striving to win glory for the country, and encouraging them to independently design smart mobile terminals to enhance their patriotism [8]. Secondly, teachers can guide students to analyze the system architecture, operating code, and single-chip microcomputer interfaces of Tmall Genie AIoT, allowing them to engage in "practical battles" in groups to explore the application of Tmall Genie AIoT in mobile terminals and smart home IoTs, fostering their team collaboration spirit. During this process, students need to carefully deliberate on microcomputer system instructions, control program codes, and circuit board interfaces, cultivating an attitude of striving for perfection, being practical and realistic, rigorous and serious, improving their craftsmanship spirit, and laying a solid foundation for future employment [9].

4.2. Build virtual experimental platforms to improve the quality of experimental teaching

In the era of artificial intelligence, college teachers can utilize virtual simulation technology to conduct experimental teaching for "Microcomputer Principles and Single Chip Microcomputer Technology," building virtual experimental scenarios for students to conduct online repetitive and virtual operations. Teachers can monitor students' online experimental operation processes in real-time, provide guidance on existing issues, and improve students' experimental operation abilities. For example, teachers can design virtual simulation experimental schemes based on serial communication teaching content, simulating different serial communication line designs and control program scenarios, allowing students to practice hands-on in virtual scenarios, deepening their understanding of serial communication-related knowledge and facilitating repeated operation practice on

their weak points to enhance their experimental operation abilities [10]. Meanwhile, teachers can review students' online operations through the virtual simulation experiment backend and evaluate their experimental processes, promptly discovering issues in their experimental operations, facilitating offline targeted experimental teaching to answer students' questions promptly and improve the quality of experimental teaching. In addition, teachers can assign virtual simulation experimental assignments, requiring students to submit virtual simulation experimental videos, evaluating students' experimental performances in real-time, pointing out existing issues, and guiding them to practice independently based on experimental tutorials, scientifically guiding their experimental course learning after class, and comprehensively improving the experimental teaching effect of "Microcomputer Principles and Single Chip Microcomputer Technology" [11].

4.3. Implement blended teaching to improve course teaching quality

College teachers should actively utilize the Learning Tong APP to carry out blended teaching for "Microcomputer Principles and Single Chip Microcomputer Technology," clarifying the connection points between online and offline teaching to improve course teaching quality. Firstly, teachers can create preview micro-lectures based on teaching content, explaining key and difficult points in the videos and assigning preview tasks, uploading the micro-lectures to the Learning Tong platform for students to preview before class, based on the micro-lectures, laying a solid foundation for online teaching [12]. For instance, teachers can guide students to analyze the architecture, interrupt, and exception characteristics of the Cortex-M3 processor in micro-lectures, allowing them to independently collect related knowledge and engage in online voice interactions with them. During online teaching, teachers can explain the Cortex-M3 processor architecture, microcomputer control codes, and single-chip microcomputer interface methods, guiding students to draw wiring diagrams and program code diagrams to stimulate their enthusiasm for online speech. Secondly, teachers can summarize data from the online teaching platform, screening out the most discussed questions by students and issues in interactive discussions, conducting offline targeted teaching for these issues to promptly resolve problems in online teaching. During online teaching, teachers can organize students to conduct Cortex-M3 processor experiments, allowing them to understand the common cases and troubleshooting methods of this processor model to help them master online teaching knowledge points, thereby improving the blended teaching quality of "Microcomputer Principles and Single Chip Microcomputer Technology" [13].

4.4. Carry out integrated teaching of theory and practice to improve students' practical abilities

Colleges and universities should actively promote the integrated teaching of industry, academia, and research, constructing a teaching mode that integrates theory and practice, inviting enterprise experts to participate in the teaching of "Microcomputer Principles and Single Chip Microcomputer Technology." On the one hand, it is necessary to incorporate typical enterprise cases to update and expand teaching content. On the other hand, experts are invited to guide students in job practice, facilitating the connection between theory and practical teaching, and improving students' job practice abilities. For example, teachers can collaborate with enterprise experts to compile integrated teaching cases of theory and practice, designing a practical training scheme for intelligent timers, with enterprise experts conducting classroom guidance, requiring students to independently write timer control programs and line interface schemes in groups to enhance their cooperative inquiry abilities [14]. Each group can first collect relevant knowledge from textbooks, discuss the timer control program codes and line interfaces, and formulate a cooperative inquiry framework diagram. As shown in **Figure 1**, based on the framework diagram, they engage

in cooperative inquiry to complete group practical training tasks. During this process, teachers can jointly guide with enterprise experts, pointing out issues in students' system design and areas where communication interfaces can be optimized, interpreting students' questions, allowing them to master timer-related theoretical knowledge through practice, improving their practical abilities, and laying a solid foundation for their future employment.

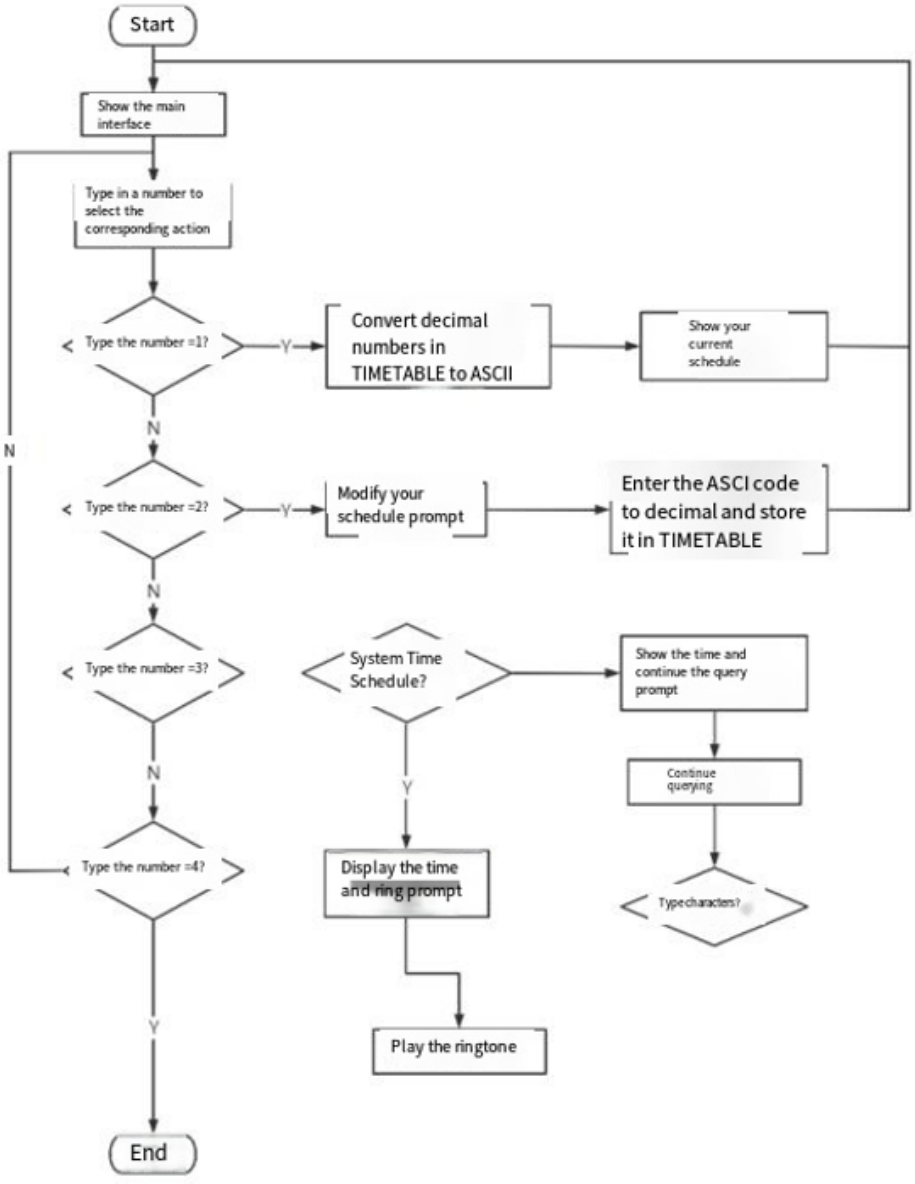

Figure 1. Framework diagram of the smart timer made by students.

4.5. Improve the teaching evaluation system to promote students' comprehensive development

A comprehensive and scientific teaching evaluation system is a powerful guarantee for advancing the teaching reform of "Microcomputer Principles and Single Chip Microcomputer Technology" and an important driving force for promoting students' comprehensive development. Firstly, teachers should actively conduct process evaluations, evaluating students' online learning, virtual simulation experimental processes, and corporate internship processes, focusing on the development of students' practical abilities, innovative abilities, and moral

qualities, promptly discovering issues in course teaching and student learning, flexibly adjusting teaching content and methods, and improving the quality of course teaching. During this process, teachers can utilize big data intelligent analysis of process evaluation indicators to objectively evaluate the teaching process and combine process evaluation with outcome evaluation to further improve the teaching evaluation system, providing a solid guarantee for curriculum reform [15]. Secondly, teachers can guide enterprise experts to participate in teaching evaluations, allowing them to evaluate practical teaching and students' experimental operation processes, promoting the connection between job skill standards and course teaching evaluations, thereby promoting the development of students' comprehensive abilities. Meanwhile, teachers can utilize the Questionnaire Star APP to conduct teaching satisfaction evaluations, allowing students to anonymously evaluate course teaching, enabling them to participate in teaching evaluations, and optimizing teaching content and methods based on their evaluation feedback to comprehensively improve the quality of course teaching.

5. Conclusion

Universities should base themselves on the background of emerging engineering disciplines and deepen the teaching reform of the course "Microcomputer Principles and Microcontroller Technology". They should empower course teaching with virtual simulation, big data, and artificial intelligence by carrying out virtual simulation experimental teaching and blended teaching. Innovations in teaching methods should guide students towards interdisciplinary and deep learning, thereby enhancing their comprehensive abilities. Meanwhile, teachers should promote the integration of ideology into courses, cultivate students' scientific research spirit, craftsmanship spirit, and patriotism. By implementing integrated teaching that combines theory with practice, teachers can improve students' practical abilities and achieve a win-win situation for course teaching and talent cultivation.

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Disclosure statement

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References

[1] Hu Y, 2024, Teaching Practice of Ideological and Political Education in the Course of "Principles of Microcomputer and Single-Chip Microcomputer Technology". Science & Education Wenhui, 2024(2): 107–110.

[2] Zhang Q, Wu L, Wang G, 2023, Exploration of Ideological and Political Teaching Reform in the Course of

Principles of Microcomputer and Single-Chip Microcomputer Technology. China Modern Educational Equipment, 2023(17): 111–113.

[3] Liu H, Hu W, 2023, Practical-Oriented Teaching Analysis of the Courses of Single-Chip Microcomputer and Principles of Microcomputer. Electronic Technology, 52(8): 368–369.

[4] Yang Y, Yang S, 2022, Research and Practice of Curriculum Reform Based on Engineering Education Professional Certification – Taking the Course of Principles of Microcomputer and Single-Chip Microcomputer Technology as an Example. Computer Knowledge and Technology, 18(9): 159–161.

[5] Chen Y, Ma C, Zhai H, et al., 2021, Data Analysis of SPOC Course Learning Behaviors – Taking the Course of Principles and Technology of Microcomputer and Single-Chip Microcomputer as an Example. Software Guide, 20(9): 248–252.

[6] Qiao J, Zhao Z, Zhang X, et al., 2021, Integrated Teaching Reform of the Courses of "Principles of Microcomputer" and "Application of Single-Chip Microcomputer" Based on the OBE Concept. China Electric Power Education, 2021(6): 63–64.

[7] Ren B, Song Y, 2020, Application Exploration of Task-Driven Method in the Teaching of Principles of Microcomputer and Single-Chip Microcomputer Technology. Education Teaching Forum, 2020(32): 268–270.

[8] Tong J, Si Z, Liang B, 2020, Exploration of the Systematic Teaching Mode of the Courses of Single-Chip Microcomputer, Electronic Technology and C Language. China Educational Technology & Equipment, 2020(6): 84–86.

[9] Peng C, Jiang X, 2020, Reform and Exploration of Teaching Method of "Microcomputer Principle and Single-Chip Microcomputer Technology" Based on Flipped Classroom. Curriculum Education Research, 2020(4): 238.

[10] Zhang F, Li L, Song X, 2023, Exploration and Practice of the Cultivation of the Course "Microcomputer Principle and Application of Single-Chip Microcomputer". Education Teaching Forum, 2023(47): 109–112.

[11] Liu W, Liu X, 2021, Teaching Design and Practice of "Single-Chip Microcomputer Course Design" Based on the OBE Concept. Electronics World, 2021(17): 103–105.

[12] Fang Y, Zhao Y, Zhu X, et al., 2024, Teaching Practice of the Course "Microcomputer Principle and Interface Technology" under the Background of New Engineering. Journal of Electrical and Electronic Teaching, 46(6): 1–5.

[13] Zhang F, Chen C, Li L, 2024, Teaching Exploration of the Theory and Practice Course of "Microcomputer Principle and Interface Technology". Education Teaching Forum, 2024(47): 109–112.

[14] Meng J, Wang C, Liu X, et al., 2024, Research on the Teaching Reform of the "Microcomputer Principle" Course under the Background of Engineering Certification – Taking Anhui Science and Technology University as an Example. Wireless Internet Technology, 21(6): 122–125.

[15] Cheng H, Cheng H, Cheng H, 2023, Teaching Research of the Course "Microcomputer Principle and Interface Technology" Based on Simulation Software. Modern Information Technology, 7(20): 185–189.