ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202506_8(6).0004

Research and Practice on the Construction System of the Hybrid Single-Chip Microcomputer Course Group with "People-oriented, internal chain integration, and External Progressive"

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Abstract

Under the guidance of the national-level first-class blended online and offline courses, with ideological and political education in courses as the carrier, student cultivation as the main line, the logical connection of course content as the bond, the cooperation of the teaching team as the support, students' learning experience as the evaluation index, and the deepening of teaching reform as the driving force, The research and practice on the construction system of the hybrid single-chip microcomputer course group with "people-oriented, internal chain running through, and external progressive" is proposed, aiming to break the barrier of the single-chip microcomputer series courses being independent, effectively reduce the repetition and omission among courses, achieve the organic integration among the related courses of single-chip microcomputer, and improve the learning experience and learning effect of students' courses.

Keywords

Teaching reform; People-oriented education; Hybrid; Course cluster construction.

1. Introduction

The concept of curriculum integration first emerged in Europe in the mid-19th century and gradually took shape in Europe and America in the 1950s. By exploring the establishment of an interdisciplinary and comprehensive university curriculum system to meet the requirements of the development of higher education towards integration and cross-integration, it has become a consensus among advanced countries in higher education abroad, and good results have been achieved in practice.

In China, with the transformation of higher education from "elite education" to "mass education", the talent cultivation model has also shifted from "specialist" training to "generalist" education. The class hours of professional courses have been significantly reduced, and there is an urgent need for an overall integration and planning of the group nature of related courses[1]. The three courses of single-chip microcomputer, Microcomputer Principles and Programmable Controller are widely offered in electronic information-related majors. They have similar knowledge systems. Relevant universities will formulate the teaching syllabuses for the three courses based on their own actual situations. Take the Automation major of Changchun University of Technology as an example. The number of students admitted to this major is about 115 each year, and more than half of the teaching staff have high academic qualifications and professional titles. The courses of single-chip microcomputer and Microcomputer Principles in this major are set in the fourth semester, while the course of Programmable Controller is set in the fifth semester.

In a large classroom with more than 100 students, during the implementation process of adopting the blended teaching flip[2], how can the efficient participation of all staff be achieved? How can we ensure that students do not get confused about the knowledge points when they

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study two courses with high similarity simultaneously within the same semester? How to complement the advantages of the three courses to maximize their effectiveness and improve students' academic performance and other issues[3] urgently need to be solved.

2. The Construction of The Course Cluster Construction System

After years of research and practice, this paper proposes an innovative curriculum chain architecture. Aiming to meet students' learning needs and enhance teaching effectiveness, the construction of this curriculum chain covers three important aspects.

First of all, we are committed to formulating a student-centered, orderly, efficient and complete large-class rotation system. Under this system, students play a more proactive role and become the main body of learning. By previewing the pre-class materials in advance, students can have in-depth interactions with teachers and classmates in class, discuss problems together and solve doubts. This flipped teaching mode can stimulate students' interest in learning and their autonomous learning ability, thereby improving the learning effect.

Secondly, we have explored an in-class knowledge chain that focuses on students' learning outcomes, connects the past and the future, and complements each other. By organically connecting the relevant knowledge points to form an orderly knowledge system, we ensure that students can understand the intrinsic connections of knowledge during the learning process, thereby forming a knowledge network. This way of constructing the knowledge chain helps students better master and apply the knowledge they have learned, avoid the isolation of knowledge, and improve the depth and breadth of learning [4].

Thirdly, we are committed to building a four-level progressive and diversified extracurricular practice system that focuses on students' learning experiences. This system encompasses various levels and types of extracurricular practical activities, such as field trips, social practices, and scientific research projects. By participating in these practical activities, students can broaden their horizons, exercise their practical abilities, cultivate innovative thinking and problem-solving skills [5]. Based on students' grades and ability levels, we have designed practical projects that gradually increase in difficulty and challenge to ensure that students can continuously grow and develop in practice [6].

The curriculum chain system structure designed this time not only focuses on students' learning outcomes, but also pays attention to their learning experiences and the cultivation of practical abilities. By establishing a student-centered flipped teaching system, an in-class knowledge chain that connects the past and the future, and a progressive and diversified extracurricular practice system, we expect to enhance students' learning motivation and effectiveness, and cultivate their comprehensive quality and innovation ability.

3. The Implementation of The Course Cluster Construction System

3.1. Establish a large-class rotation system

The nature of the three courses is all professional basic courses. The course "Principles and Applications of Programmable Controllers" is offered to the four majors of Automation, Measurement and Control, Electrical Engineering and Intelligence in the School of Information and Control of our university. The course "Principles and Applications of Single-Chip Microcomputers" is offered to the five majors of Automation, Measurement and Control, Electrical Engineering, Intelligence and Telecommunications in the School of Information and Control Engineering of our university. The course "Principles and Applications of Microcomputers" is offered to the computer major of the School of Information and Control Engineering of our university, and all are taught in large classes. In response to various

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problems arising from the large-class rotation in blended teaching, the following specific large-class rotation system has been formulated:

(1) Stipulate student participation: In the large-class flipped classroom, all students must actively participate in learning. Students need to preview the relevant course content in advance, prepare questions and discussion materials, and actively participate in classroom discussions and interactions.

(2) Group learning: To increase opportunities for interaction and cooperative learning, students will be divided into groups. Each group is composed of students from different majors to promote cross-disciplinary communication and learning.

(3) Resource sharing: Teachers will provide relevant learning resources, including teaching videos, documents and practice exercises, etc. Students can obtain these resources through online platforms before class and share their experiences and answers with each other during the learning process.

(4) Lecture-style guidance: In the classroom, the teacher will organize lecture-style guidance, focusing on explaining the core concepts and difficult points of the course [7]. Meanwhile, teachers will encourage students to ask questions and present the questions and discussion materials they have prepared during the preview.

(5) Group discussions and projects: In addition to lecture-style guidance, students will have the opportunity to engage in group discussions and project practices. Teachers will arrange some case analyses and practical problems, requiring students to solve them collaboratively within groups and present their achievements to the whole class.

(6) Feedback and Evaluation: Teachers will promptly provide feedback to students to encourage their learning progress. In addition, teachers will evaluate students' performance in group discussions and projects to promote their active participation and cooperative abilities [8].

Through the above system, we aim to create a student-centered, orderly, efficient and complete large-class flipped classroom. This will stimulate students' interest in learning, cultivate their cooperative ability, and enhance their understanding and application ability of professional basic courses.

3.2. Explore the knowledge chain within the class

For the theoretical teaching tasks of the three courses, the modules involved include CPU, memory, input/output interfaces, etc. The contents of these courses are highly similar. However, since these courses are offered in different semesters or in the same semester, this may lead to problems such as fragmented knowledge or confusion of knowledge points among students. To solve these problems, we should focus on students' learning outcomes and build an in-class knowledge chain that connects the past and the future and complements each other. Specifically, the following measures can be taken:

(1) Clear teaching objectives: Each course should set clear teaching objectives to ensure that they differ in knowledge content and skill development, avoiding knowledge repetition and overlap.

(2) Progressive teaching: When designing courses, students can be gradually guided to master knowledge based on their difficulty and complexity [9]. For example, in the first course, one can start from the basic hardware knowledge, such as the structure and functions of the CPU; In the second course, the principle and operation of the memory are gradually explored in depth. Finally, in the third course, the relevant knowledge of input and output interfaces is introduced. In this way, students can establish an organic knowledge chain and gradually learn and understand the relationships among various modules.

(3) Course connection and review: At the end of each course, a review session for relevant knowledge points can be set up to help students sort out the learned content and deepen their memory. Meanwhile, the next course should also review and connect the core concepts of the previous course, enabling students to understand the connections between the previous and subsequent knowledge and integrate the knowledge of different modules.

(4) Practice and Case Analysis: In addition to the explanation of theoretical knowledge, practical sessions and case analyses can also be introduced to enable students to have a deeper understanding and application of the knowledge they have learned through actual operations and the resolution of specific problems. This can enhance students' interest in learning and deepen their understanding and memory of theoretical knowledge.

By focusing on the construction of an in-class knowledge chain that emphasizes students' learning outcomes, connects the past and the future, and complements each other, the problems of knowledge fragmentation and confusion of knowledge points can be avoided in teaching, helping students systematically learn and apply knowledge.

3.3. Build an extracurricular practice system

All three courses have corresponding practical links, providing favorable support for subsequent various design and software and hardware development courses. And the subject competitions related to the three courses: "College Students' Electronic Design Contest", "World Robot Contest", "Internet Plus College Students' Innovation and Entrepreneurship Contest", "China Intelligent Manufacturing Challenge", "Jilin Province College Students' Artificial Intelligence Innovation Contest", etc., are important platforms for students to showcase their practical and hands-on abilities. The practical skills level of the three courses is also an important factor for college students majoring in electrical engineering to find employment. In response to the problems such as the lack of "effectiveness" in students' course practice links, a "four-level progressive diversified extracurricular practice system focusing on students' learning experiences" is constructed.

4. Key Issues in The Implementation Process of The Practical Teaching System

In the process of implementing the flipped blended teaching, ensuring the efficient participation of all staff is a key issue. Furthermore, if two courses with high similarity are studied simultaneously within the same semester, measures need to be taken to ensure that students do not confuse the knowledge points. Furthermore, how to complement the advantages of the three courses to maximize the improvement of students' academic performance also needs to be addressed. In response to these problems, we urgently need to find solutions.

(1) Centering on "large-class rotation", address the issue of "students not knowing or unwilling to study independently during the self-study stage before class; During the flipped stage in class, students who did not directly participate did not listen carefully or think deeply. Problems such as "knowledge not being consolidated and improved in a timely manner during the internalization stage after class".

(2) Centering on the "information knowledge chain", solve the problem of "how to effectively extract the overlapping parts of the knowledge systems of the three courses and establish a harmonious course chain relationship; How to summarize the different theoretical concepts of the three courses and highlight the characteristics and differences of individual courses and other issues.

(3) Centering on the "practical system", address the issue of "how to make most beginners of the course who are 'afraid to touch hardware and dare not touch software' interested in hands-

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202506_8(6).0004

on practice, confident in challenges, and gain from practice." Ultimately, issues such as cultivating them into high-level applied talents.

5. Research Plan for Key Issues

(1) Conduct in-depth research on the problems existing in the large-class rotation. Centering on students, starting from three levels - the entire period of "before class, during class and after class", the entire group of "flipped groups, defense groups and other groups", and the entire group of "presentation members, debate members and other members" - comprehensively examines various problems existing in the large class flipped group and provides solutions one by one. Design the detailed rules for flipping and provide the implementation process.

(2) Deeply cultivate the knowledge framework system of the three courses. In order to improve the learning effect of students in the three courses, taking "CPU, memory, and I/O interface" as the three main lines, running through the entire course chain, seeking the internal correlation of the course chain and summarizing the external individual differences of the course chain.

(3) Build a "four-level progressive practice system". In order to enhance students' learning experience, a four-level progressive extracurricular practice system is constructed starting from the four aspects of interest, confidence, fighting spirit and ability. The first layer: Carrier platform - Attracting people; Second level: Case-driven - Training people; Three levels: Subject competitions - Inspire people; Level Four: Project Participant - Project Improver. Effectively solve the problem of students' lack of practical hands-on ability. As shown in Figures 1and 2.

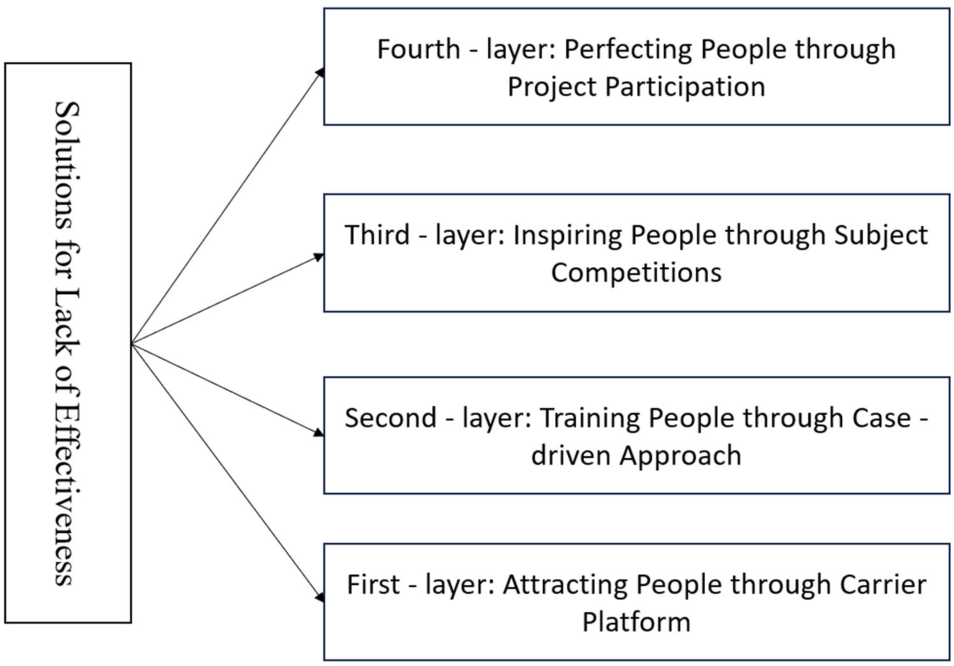

Figure 1. Shows the lack of solutions for practical effects

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202506_8(6).0004

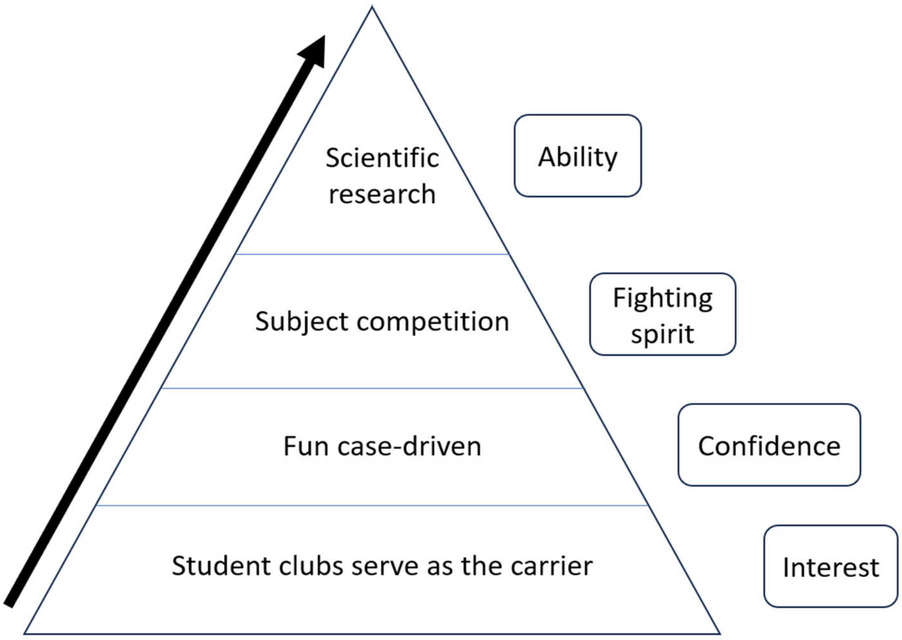

Figure 2. Four-level progressive practice system

6. Summary

Through the construction of this system, the aim is to solve the contradiction between "class hours and content", and achieve the maximization of course benefits and the optimization of students' course experience. Teachers are the core of the construction of the curriculum cluster. While improving students' abilities and qualities, they achieve mutual growth in teaching and learning. This system has been applied and practiced to a certain extent in various majors of the School of Information and Control Engineering of Jilin Institute of Chemical Technology, achieving remarkable results. It has enhanced students' ability to integrate similar disciplines and enabled them to apply similar knowledge points by analogy. Moreover, the construction of this system has further exerted the exemplary, leading and promoting role of our university's national-level blended first-class course "Principles and Applications of Single-Chip Microcomputers". Practice shows that the construction system of the hybrid single-chip microcomputer course group has good application value and promotion value.

Acknowledgements

Project of the Department of Education of Jilin Province (Approval Number: 20224BRI9IC007H);

References

[1] Li Jing, Liu Ximei, Yu Shajia Construction and Practice of the Experimental Teaching System of the Electrical Engineering Course Group [J]. Experimental Science and Technology, 2023, 21(02): 92-96.

[2] Wang Ying, Xu Jiaojiao, Liu Qi, et al. Teaching Reform of Single-chip Microcomputer Based on Online and Offline Hybrid Large-Class Flipping [J]. Journal of Jilin Institute of Chemical Technology, 2021, 38(04): 14-18.

[3] Liang Yixuan The Core Issues Restricting the Integration of Information Technology and Mathematics Curriculum [J]. Asia-pacific Education, 2023(05): 7-9.

ISSN: 2637-6067 DOI: 10.6918/IJOSSER.202506_8(6).0004

[4] Ma Yonghong, Zhang Xiaohui. The Connotation, mechanism and Evolution Path of Interdisciplinary Studies [J]. Educational Research of Tsinghua University, 2023, 44(01): 30-37.

[5] Wang Chunyan, Wang Guicheng, Yang Jianfeng, et al. Research on Progressive Project-based Teaching of Practical Courses [J]. China Educational Technology Equipment, 2021(24): 118-121.

[6] Feng Chong. Research on the Multi-level Progressive Model for Cultivating Students' Engineering Practice Ability [J]. China Extracurricular Education, 2017, (33): 74+83.

[7] Yu Qingcai, Miao Yongmei, Wang Yan. Discussion on the Application of Academic Lecture-style Teaching in the Frontier Progress Course of Disciplines [J]. Research and Practice of Innovation and Entrepreneurship Theory, 2023, 6(09): 140-143.

[8] Liang Guobiao, Jiang Rong, Zhang Jianzhan. Research on the Application of Classroom Feedback System in College Classrooms [J]. China Education Informatization, 2017(03): 26-28.

[9] Hong Yu. On the Progressive Teaching Method of Computer Programming Practice [J]. Educational Teaching Forum, 2017(38): 267-268.