Construction and Practice of High Quality Course "Fundamentals of Programming"

Yang Yan[a], Wenbo Huang[b,*], Guangjie Liu[c]

School of Computer Science and Technology, Changchun Normal University, Changchun, China

[a]yanyang2016@hotmail.com, [b]huagnwenbo@sina.com, [c]liuguangjie@cncnc.edu.cn

*corresponding author

Keywords: course construction; programming basis; C language; undergraduate teaching; teaching reform

Abstract: The Combined with the characteristics of the course of "Fundamentals of Programming" and undergraduate teaching in application-oriented colleges, this paper expounds the construction of high-quality course of "Fundamentals of Programming" from the aspects of the practice of curriculum teaching reform and the main problems existing in the implementation process, and puts forward the following suggestions: establishing the teaching goal of gradient drop, establishing the teaching concept based on interest, and adopting diversified teaching forms and a series of teaching reform measures such as comprehensive assessment.

1. Introduction

Programming occupies the core position in the computer science system. “Fundamentals of Programming” is a professional basic course in the computer college of our university. Students of all majors in the computer college need to study this course, and there are about 300 students each year. How to make students have a comprehensive understanding of the basic theory and have the ability of C programming is the teaching goal of this course. In order to better cultivate practical talents oriented to application and meet the needs of enterprises, we apply for the construction of high-quality course “Fundamentals of Programming” in our university, in order to improve the quality of talent training.

2. The Practice of Curriculum Teaching Reform

2.1. Achievements Oriented Teaching Reform Mode

The teaching reform of this course is based on the ultimate goal of application-oriented professional talents training, focusing on the lifelong sustainable development of students, emphasizing the collaborative cultivation of professional skills and comprehensive quality, taking believing in students' learning potential, paying attention to students' dominant position and recognizing students' learning achievements, and through the organic application of multiple links, methods and means, implementing the results oriented reform of classroom teaching mode, enhancing the positive role of classroom teaching in students' learning ability, innovation ability, communication and expression ability and team cooperation ability, improving the comprehensive effect and internal quality of classroom teaching, and further playing the main channel role of classroom teaching in the cultivation of professionals. Teaching reform mainly through the adjustment and attempt of teaching methods, teaching objectives, teaching ideas and means, evaluation mode and other aspects to reflect the results oriented education thought.

2.2. Construction Content

2.2.1. Improve the Syllabus.

In the course construction, we highlight the role of teaching syllabus as a baton, keep up with the

  DOI: 10.25236/ieesasm.2020.013

development of new technology, update teaching content, improve the compilation of teaching syllabus, accumulate teaching resources, select high-quality teaching materials, and highlight the main line of programming ability training.

2.2.2. Strengthen the Core Content.

In the teaching content of the course, the emphasis and difficulty of programming, the connection and difference of various knowledge points among courses are highlighted, which runs through the whole teaching process. The introduction of practical engineering tasks as the teaching content, guide students to learn programming skills, and strive to combine with the actual, so as to deepen the teaching content of the course.

2.2.3. Emphasize the Cultivation of Practical Ability.

We select practical problems for practical teaching, increase design experiments and comprehensive experiments, reduce confirmatory experiments, and guide students to analyse and choose correct solutions. Through the introduction of scientific research-based comprehensive topics, students' ability of practical practice, cooperative research and collaborative development of large-scale software projects is cultivated, and the practical application ability of students will be improved.

2.3. Implementation Plan

2.3.1. Reform of Teaching Methods

In the course of programming, the main line is programming method, grammar and structure is the core, the goal is to cultivate design ability and improve learning interest, pay attention to the combination of theory and practice, and change the exam oriented to application. Based on the practical application, we analyse the design ideas of the program and evaluate the performance of the program. The students are guided to study by using various teaching modes such as classroom teaching, homework, special lecture and class discussion.

2.3.2. The Implementation of Teaching Organization and Reform of Teaching Content

Taking the improvement of the syllabus as the foundation, following the development of new technology, the role of the command bar of the syllabus should be highlighted in the course construction, the teaching contents should be updated constantly and the preparation of the syllabus should be improved. Around the syllabus, the students' programming ability should be trained; grammar details reduced and teaching organization with integrated knowledge structure should be increased. Pay attention to the knowledge structure's foundation, practicability, advanced and systematises. The content of teaching should be combined with the latest scientific research results, and integrate the latest research achievements into the teaching contents, so that students can understand the latest research trends and achievements, and stimulate students' learning enthusiasm.

2.3.3. Experimental Teaching

Combining the construction of the "three combination" practice mechanism of the scientific competition platform, the school enterprise cooperation training platform and the university students' innovation and entrepreneurship platform, the sub items and sub modules in the practical research are introduced into the practical teaching, so as to enhance the students' practical application ability of the algorithm. In the experimental phase, the proportion of comprehensive experiments is improved. According to the principle of "less but more refined", compress and select the experimental items and contents, improve the efficiency of the experiment, and make the combination of experimental teaching and theory teaching more closely.

3. Implementation and Effect of Curriculum Teaching and Moral Education Integration

Inside everything is the unity of affirmation and negation. Dialectical negation is a link in the development of things. Dialectical negation is the production of new things and the destruction of

old things. Taking "pointer" as an example, the philosophy of affirmation and negation is embodied in the process of accessing the permission of local variables. Obviously, the pointer is very effective in changing the data context environment, such as detecting the storage order supported by CPU, which provides great convenience for calculation, which is worthy of affirmation. But at the same time, pointer for beginners also hidden danger, if not used properly, there will be a lot of inexplicable errors, serious may lead to program paralysis, in view of the above situation to give a negative. From the above discussion, we can see the relationship of unity of opposites between affirmation and negation. They are interdependent, contain and permeate each other. Under certain conditions, affirmation and negation transform each other. Any negation is the result of the internal contradiction movement of things. Through self-negation, self-movement and self-development can be realized.

Master solid theoretical knowledge, deeply integrates with practice, and cultivate students' professionalism. First of all, in the professional laboratory, students should operate in strict accordance with the experimental steps, do a good job in each experiment, and achieve "correct operation, careful observation, careful analysis and scientific summary". Secondly, when students are in the off campus training education base and entrepreneurship demonstration base, they should emphasize the application of theory in practice, train their practical ability, operation ability, innovation ability and team coordination ability, and let practical training be the touchstone to test theoretical teaching. To cultivate the students' nature of excellence, perseverance, patience, indifference to fame and wealth, and constant innovation, which could call on students to set up the awe of science and their future career, stimulate their enthusiasm for their studies, and ensure that their work meets the requirements of customers, reaches the industry standards, and uses rigorous, meticulous, and continuous improvement Professional attitude creates greater contribution.

4. Integration Plan of Curriculum Teaching and Innovation and Entrepreneurship Education

4.1. Perfect Innovation Ability Training System

In practice teaching, the connotation is constantly enriched and the extension is expanded, and "the education means is transformed from the traditional to the future, the training discipline is changed from engineering to multi subject, the training project is changed from single to comprehensive, the training level is changed from low level to high level, the training direction is from skill to quality, and the training focus is changed from foundation to innovation", which would provide high-quality resources for the cultivation of students' innovative spirit and innovative ability.

4.2. System Science Practice Teaching System

We should adhere to the road of combining "teaching, scientific research and social services", and form a mode of taking practical teaching as the main body, promoting teaching by scientific research, and promoting the sustainable development with social services. We should make full use of the innovative training centre of AI and AI technology, and the special training projects that include computing thinking, Internet plus thinking and AI thinking. Improve the students' ability to integrate and innovate the programming ideas under the background of artificial intelligence and big data era.

4.3. The Implementation and Effect of the Integration of Curriculum Teaching and Modern Information Technology

The online teaching activities are carried out by adding MOOC online materials, online tutoring system, online experiment system, online examination system and online open courses, so as to fully integrate with modern information technology and improve classroom efficiency.

5. Achievement, Experience and Effect of the Course Construction and Teaching Reform

Through holding a forum between teachers and students and feedback on the survey of students,

we found that in the teaching process after the use of programming teaching reform mode, through the adjustment and transformation of teaching methods, teaching objectives, teaching ideas, teaching resources, teaching space and teaching forms, and introducing the teaching concept of achievement orientation, we can fundamentally improve the quality of teaching. Its effect is mainly reflected in the following aspects.

First, the teaching results designed by the reverse design method can reflect the position and significance of the course in the process of talent cultivation more intuitively and accurately. Due to the full consideration of students' career planning in the process of goal formulation, it makes the formulation of teaching objectives more scientific and reasonable, and more easily accepted and implemented by students. In the teaching process, the course can carry out the course teaching from the perspective of the overall situation，it gradually plays a role of infiltration for the follow-up courses, so that students can learn in a knowledge system in the learning process, making the teaching effect multiply.

Second, the flexible teaching methods and advanced and mature teaching concepts make students' interest in learning and students' self-learning ability improved significantly. We through a variety of means to mobilize the enthusiasm and initiative of students to learn, the fun of learning throughout the teaching, so that students realize that autonomous learning is not only the task to be completed at this stage, but also throughout the life-long professional quality.

Thirdly, the teaching concept of achievement oriented cultivates the team spirit of students, which improves their ability of synthesizing information and organizing.

6. Analysis of the Main Problems and Causes in the Process of Curriculum Construction and Curriculum Teaching Reform

Through the analysis and reflection of the current classroom teaching reform of programming, the existing problems and reasons are as follows:

First, the comprehensive effectiveness of classroom teaching has not been brought into full play. In the existing classroom teaching, the role of classroom teaching in the cultivation of students' ability and quality has not been fully played.

Second, the subjectivity and potential of students have not been fully stimulated. In the existing classroom, students sometimes are in a passive state of receiving or listening to lectures. There are less opportunities and time for positive thinking, active expression and interactive discussion, as well as for insufficient subjectivity and active learning. Teachers are still the masters of the classroom. How to reflect that students are the masters of learning and how to return the initiatives of the classroom to students need to be further solved and implemented.

7. Curriculum Construction Objectives, Construction Ideas and Improvement Measures in the Next Stage

In order to effectively solve the problems in the teaching of programming course and improve the teaching quality, we will continue to take the achievement oriented theory as the starting point, according to the actual situation of students and training results, through the reform of classroom teaching methods, use scientific teaching methods to cultivate students' interest in learning programming language, stimulate students' learning initiative, strengthen and attach importance to practice, and we will emphasizes the full combination of theory and practice, and cultivates students' innovative thinking ability and thinking habit.

7.1. Establish the Teaching Goal of Gradient Progression

The designation of teaching objectives is the premise and foundation of achievement orientation. Curriculum teaching objectives should not be purely theoretical knowledge teaching objectives, but should focus on the transformation from single knowledge teaching to "knowledge learning, ability training, quality improvement" teaching objectives. For the different level students, the teaching objectives should take into account the individual differences and the enthusiasm of students, and

formulate corresponding teaching objectives step by step, so that students can reflect their own achievements. The design of teaching objectives can adopt the principle of reverse design, proceed from the results, gradient progress and advance step by step. The starting point of teaching is not what the textbook requires teachers to teach, but what to learn to achieve the final results.

In this mode, the classroom will not only be a place for students to acquire knowledge, but also an important place to cultivate their ability and improve their quality. The key of this link lies in: teachers should have a deep understanding of the professional talent training objectives involved in the curriculum, be able to clearly understand the specific role of the curriculum in supporting the talent training objectives, including which professional talent training standards the curriculum can support and influence, and what kind of relationship it has with other courses, so as to integrate considering the curriculum into a complete curriculum system. We should know what the relationship is between the phased learning outcomes and the overall learning outcomes, and what the students can finally achieve, so as to cooperate with the students to achieve the teaching objectives.

7.2. Establish the Teaching Concept of Interest Oriented

From the traditional classroom teaching concept of "teacher-based, teaching-based, task-based" to the modern teaching concept of "student led, fun guided, team cooperation". The key point is not only that teachers need to break through the dominant position of classroom teaching in their minds, but also to let students who have been used to passively accept the arrangement of teachers to experience the fun of learning and the pleasure of constantly surpassing themselves, and take the achievements as the starting point for obtaining greater achievements. In the process of transformation, it is not only necessary to make explicit education and guidance, but more depends on the implementation of teaching reform process imperceptibly.

In the interest-based teaching concept, it emphasizes the cultivation of cooperation spirit and team consciousness among students. Between students and students, between students and teachers, they are not in the competitive environment, but the team members who jointly develop and promote the sublimation. In the process of cultivating students' interest, teachers are also the allies of students. And "cooperation oriented" refers to the mutual aid and cooperation between students, which will make the strong learner ability stronger, and the weak learner ability improved, and ultimately achieve the common improvement of all.

7.3. Adopt Diversified Teaching Methods

Through question oriented and case driven, the classroom teaching is changed from single teacher's explanation to teacher and student's speech feedback, and combined with student's group discussion and practice. Combining the teaching objectives, teaching contents and expected results of each class with appropriate teaching methods, the organic linkage of various teaching means can be realized. In the transformation of teaching form, we should pay attention to the cultivation of students' critical inheritance thought. In the process of group discussion, we can guide students' correct direction by carefully designing some wrong cases, and encourage students to think critically, reason, feedback and act, instead of accepting the teacher's teaching in an all-round way, so as to cultivate students' ability to think independently and solve problems.

7.4. Comprehensive Assessment Method

The assessment mechanism is divided into three parts: theoretical assessment, experimental assessment and practical assessment. Theoretical assessment focuses on students' mastery of theoretical knowledge, experimental assessment focuses on the mastery and application of basic knowledge and basic skills, and practical assessment focuses on basic ability and basic literacy. In view of some assessment standards, it focuses on the target requirements set by the students themselves, and according to their respective reference standards. In the assessment results, students are not classified by grade, and the assessment standard emphasizes whether they have reached the self-reference standard. In the assessment process, pay attention to the assessment of students' comprehensive quality, such as students' ability of expression, communication, and team

cooperation. In the assessment mechanism, the assessment is carried out according to the project team. The assessment is composed of teacher evaluation, group self-evaluation, team members' mutual evaluation and inter group mutual evaluation.

In addition, we will improve the professional level of the teaching staff through training teachers, strengthen the cross integration with other disciplines, strengthen the domestic and international exchanges and cooperation, and build the "Fundamentals of Programming" course into a demonstration course reflecting modern teaching ideas and innovative spirit.

8. Conclusion

The construction of high-quality curriculum is a long-term construction project to improve the quality of teaching. Teaching methods and contents need to change with the changes of teaching objects and social needs. This paper introduces the construction of the high-quality course "Fundamentals of Programming" in our university. It is hoped that through the reform and construction of the course, students can better grasp the knowledge involved in the course, and can be well applied to solve complex engineering problems. However, due to the time relationship, we still have some work to do to build the course into a high-quality course or even a top-quality course, such as further strengthening the construction of laboratory conditions, enriching the intelligent system development platform, carrying out online teaching and answering questions based on the college campus network, and expanding the teaching time and space. The course team will continue to conduct in-depth research and active exploration to further improve the quality construction of the course.

Acknowledgements

This research is funded by The 13th five year plan of Education Science in Jilin Province" Exploration and Practice of STEAM Education System Construction in Primary and Secondary Schools of Jilin Province" (Contract Number: GH180723) and Research on Teaching Reform of Jilin Provincial Department of Education (Contract Number: 2018ZCY409). It is also supported by Research Topic of Higher Education Teaching Reform in Jilin Province in 2020(JJG [2020] No. 17).

References

[1] Lee S. Knowledge and Teaching: Foundations of the New Reform[J]. Harvard Educational Review, 1987, 57(1):355-356.

[2] Popkewitz, ThomasS. A political sociology of educational reform: power/knowledge in teaching, teacher education, and re[M].

[3] Spillane J P , Zeuli J S . Reform and Teaching: Exploring Patterns of Practice in the Context of National and State Mathematics Reforms [J]. Educational Evaluation & Policy Analysis, 1999, 21(1):1-27.

[4] Jia-Ning X U , Wen-Hai H , Ying-Hua W , et al. Deepening the Reform of Experimental Education and Course construction to Set up the Demonstration Center of National Experimental Education[J]. Research & Exploration in Laboratory, 2007.

[5] Xiong Xingming, zhangwenxi, Yan Ke Sheng. Course construction and teaching reform on "the controlling technology on factory electricity"[J]. Journal of Changsha University, 2004, 018 (004): 71-73

[6] SHI Zhong ying. Tacit Knowledge and Teaching Reform[J]. Journal of Bjing Normal University, 2001.