Teaching Research and Reform of Programming Course Based on Subject Competition

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Abstract—**To improve cultivation quality of applied talents, further studied the existing problems in teaching mode of programming language, and proposed new reform solutions based on "practice and innovation". It firstly elaborated how to construct the curriculum system of programming. Take subject competition as an opportunity, explored characteristic teaching modes such as "inside and outside the class, teaching competition fusion", "flipped classroom", "Theory + Experiment + Design", etc. Then improved diversified assessment methods and established a team with an orderly system of succession. Finally verified by practice in school, the teaching reform has achieved good results.**

Keywords—subject competition; the curriculum system of programming; teaching mode ; diversified Assessment; a team with an orderly system of succession

I. INTRODUCTION

"programming" is the core course of computer specialty in Colleges and universities, its teaching goal is to make students master the idea and method of programming, as well as the basic programming process and skills[1]. Traditional teaching generally use "explain---demonstrate---computer operation", Centered on faculty of explanation and demonstration, students can only passively accept and imitate. To some extent, it has killed students' creative ability and practical ability, but also lacked high-strength training of computer thinking[2], this teaching mode is difficult to cultivate high-level computer talents. But Subject competition requires students use their analytical, problem-solving abilities to solve a problem. Students who entered a competition, their innovation and practice ability has improved significantly, Thus subject competition is an effective way to motivate students to improve their thinking, to set up the innovation consciousness and to improve the programming level.

II. EXISTING PROBLEMS IN TEACHING MODE

Programming is a compulsory course for computer majors, which is mainly to cultivate students' ability to solve problems, but in practical teaching, there are some problems as follows:

A. The Programming Curriculum System Positioning and Target are not Clear

Programming courses include C/C++, Java, data structure, algorithm analysis and design, etc.. Each teacher in teaching has not formed a unified understanding, students unable to master the knowledge from the design idea, program structure, so as to encounter the actual problem, they do not know how to proceed.

B. Emphasis on Theory but Neglect Practice

1) Lack or shortage in practice teaching hours.
Programming courses are usually used in the form of "48+16". that is, 48 theoretical hours(in classroom)+16 practical hours(in computer room). Due to students' poor self-control, in unsupervised case, they almost don't contact programming in their spare time. which makes 16 hours of practice to train students' practical ability has become impossible.

2) Practice teaching is based on the verification experiment, ignoring the students' ability to analyze and solve problems.
The verification experiment to verify the results of repetitive experiment which is usually refers to the known experimental results, consolidate and strengthen the knowledge content and training practical ability. Students usually do not analyze and solve the problem independently in the process of completing experiment, so as to encounter the actual problem, they do not know how to proceed.

3) practical teaching is based on individual tasks, ignoring the students' ability of group collaboration.
As the validation experiment does not require students to ponder or seek help , as long as the basic knowledge can be verified, there is no need to communicate between with other students, which leads to no group cooperation consciousness.

C. Do not Attach Importance to Practical Ability Evaluation.

At present, the examination of the university is mainly focused on the memory contents and the ability of reading and writing code, ignoring to evaluating the actual ability of

programming and debugging, and even not involve innovation ability, so that students only care about the results, do not care about learning process[3,8].

III. REFORM IDEAS

The lack of the practice teaching hours in our school seriously restricts the cultivation of students' practical ability, and it is difficult to cultivate high level computer talents. Therefore take the "subject competition" as an opportunity , according to the personnel training mode carries out a series of reform, there are aspects as follows(as shown in Fig. 1):

- In order to meet the software talents needs of the enterprise, for different objects and training target, formulate the multi-level, systematic programming curriculum system.

- Reform programming teaching mode , strengthen the practice teaching better integration with theory teaching, explore practice teaching mode based on subject competition with innovation ability.

- Improve diversified assessment methods of programming course.

- Carry out multi-level programming competition, establish a team with an orderly system of succession
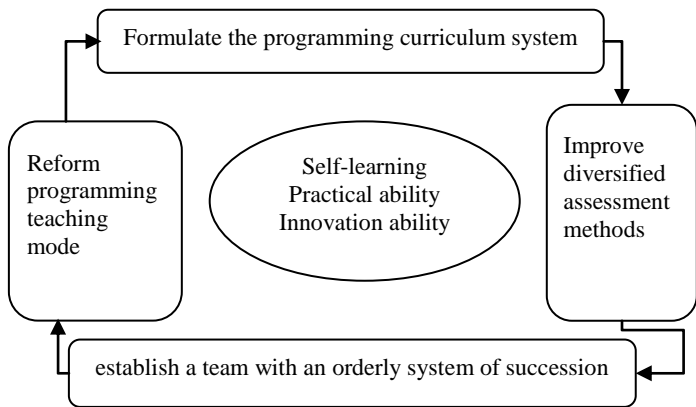

Fig. 1.　Reform ideas of programming course

IV. REFORM SOLUTION

A. Reform of The Curriculum System

Programming Course contains multiple courses(Python, C/C++, Java, data structure, algorithm analysis and design, JavaEE, etc.), seemingly unrelated, but in fact closely linked. In order to make the students use the computer thinking to solve problems, and enhance their programming practice ability , the content of the subject competition and the curriculum system are closely integrated, and formulate the competition-driven, multi-level, systematic programming curriculum system. as shown in Fig. 2.
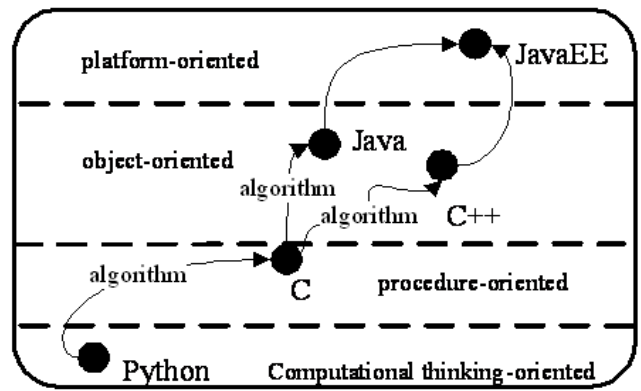

Fig. 2.　The programming curriculum system which is integrated subject competition

B. Reform of Teaching Modes

1) Teaching mode of "Inside and outside the class, teaching competition fusion"

Programming experiment is the key to the teaching, helping to master the knowledge of classroom taught. In our teaching practice, we combine teaching with competition, and bring the content of competition into teaching plan, and set up the experiment of simple to comprehensive step by step. Using Online Judge system of Hangzhou Dianzi University, as shown in Fig. 3. the system complete the ranking according to some rules, so as to stimulate students' competitive psychology and improve students' learning interest.
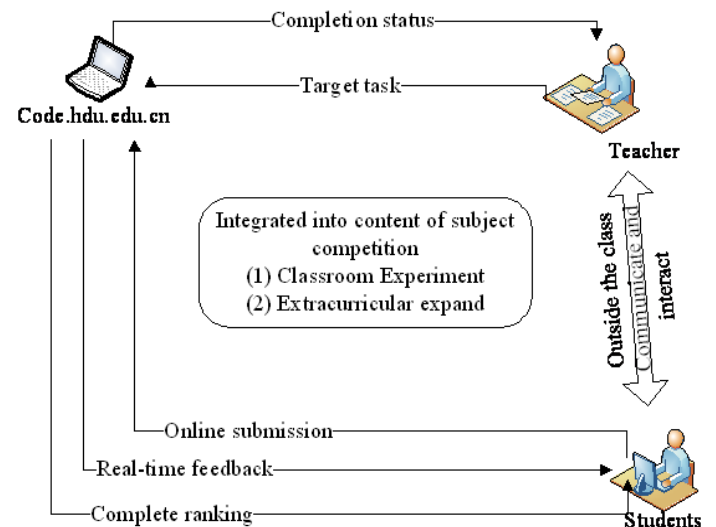

Fig. 3.　"Inside and outside the class, teaching competition fusion" practical platform

2) Teaching mode of "Flipped Classroom"

In the teaching process, in order to get rid of the cramming method , according to the actual situation of students, teachers combines with subject competition, formulate a personalized training plan, so as to realize hierarchical teaching. as shown in Fig.6. Before class, students can choose time to study, complete the selection of video learning according to their

own practical ability , while training the students' ability to learn[6]. In classroom instruction,it is no longer teacher's talk, student's listening,now more interaction and discussion can better stimulate students' initiative learning enthusiasm. such a teaching mode to cultivate students to become more adventurous and creative ability.

3) Teaching mode of "Theory + Experiment + Design"

Programming courses are practical strongly, for this feature, increase one or two weeks of practical teaching, that is, "curriculum design"[5]. as shown in Fig. 4. It not only stimulate the students' learning interest, broaden the students' thinking, is more conducive to cultivate students' ability to analyze problems and solve problems.

The verification practice is based on the key points of curriculum design, to expand the extension knowledge point as the auxiliary, to train students' basic skills with basic knowledge. Through practice, students can grasp basic knowledge such as grammar and sentence elements, etc. of programming language, lay a solid foundation for further practice smoothly.

The comprehensive and design practice is the comprehensive operation of training basic knowledge, generally requires students to complete, strengthen students' ability to analyze and solve problems, and not pay attention to grammar, sentence format and other issues.

The open and exploratory practice is under the premise that students have mastered some practical skills, and students are grouped to design the practice program. Teachers can guide students to expand their knowledge through curriculum practice, improve the innovative thinking and teamwork ability[10].
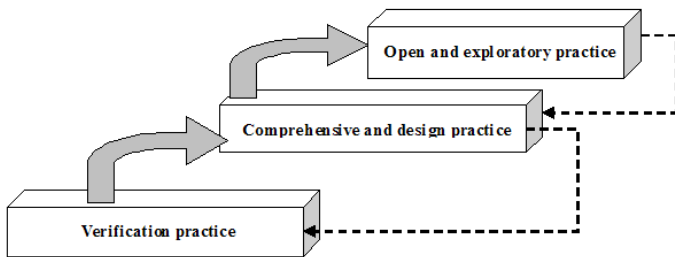

Fig. 4.   The practice teaching of curriculum design

C. Reform of Diversified Assessment Method

Assessment is an important way to evaluate the teaching effect and to measure the learning effect. It should be based on the assessment practice and innovation ability, and establish a comprehensive evaluation method[7]. Establish a multi-Cumulative Performance evaluation system, which is based on practical ability, as shown in Fig. 5. The main measures are: Using computer test, the machine can achieve real-time score by automatic scoring system. and it can more objective and fair assessment of the students' practice ability, in particular, the debugging ability of program[4].

D. Establishment of The team with an Orderly System of Succession

Take the "subject competition" as an opportunity, in order to promote teaching and learning, we need to organize a high-quality team ,improve their ability by scientific training. The experience of programming competition is insufficient in our school, focus on establishment of a team with an orderly system of succession. Organize students to participate in school selection, select outstanding students to organize into a small team, and focus on training them, establish "1+1" mechanism of old team member help new team member[9]. At the same time, the algorithm runs through the process of classroom teaching and the practice of teaching. Inspire computational thinking, highlight the guiding role of the programming competition, lay the foundation for the team selection.
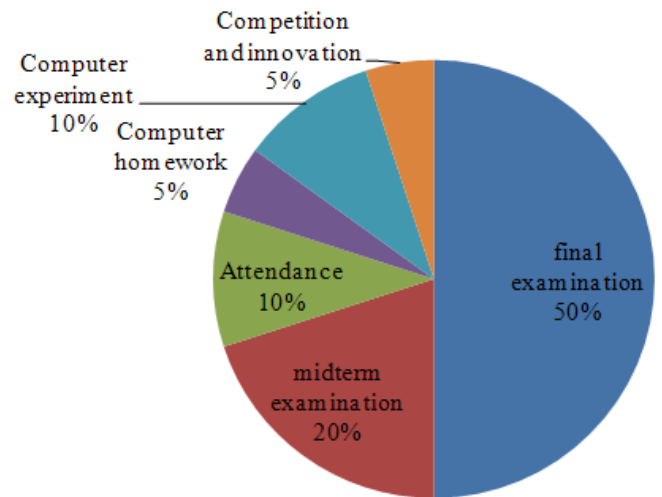

Fig. 5.   Multi-Cumulative Performance evaluation system of the Programming curriculum system

V.   REFORM EFFECT

Our School began with subject competition-driven teaching reform since 2013, compared with 2012, the reform has achieved good results, the main effect is as follows:

- The establishment of programming curriculum system makes most students can master the knowledge from the design idea, program structure, so as to encounter the actual problem, they can solve easily.

- The reform of teaching mode("Inside and outside the class, teaching competition fusion","Flipped Classroom","Theory + Experiment + Design"), make students become the main body of classroom, greatly improving the students' programming interest.

- The reform of the diversified assessment method makes the evaluation more fair and equitable, and promotes the cultivation of students' practical ability and innovation ability.

- The establishment of the competition team promote the cultivation of group collaboration ability.

After the reform, according to subject competition integrated into programming course before and after, we have made a comparative analysis, as shown in Fig. 7. Students' programming interest is increased from 36.5% to 73.9%, laid a solid foundation for the future study. Students who were selected into competition team is increased from 5.9% to 20.6%,the Award winning ratio is increased from 40.6% to 82.4%, has been significantly improved, the effect was significant.

VI. CONCLUSION

Verified by practice, the teaching reform promotes construction of the programming curriculum system based on subject competition. Combined with the needs of enterprises to determine the training objectives, explored characteristic teaching mode, cultivated students' practice and innovation ability. In the future, we will continue to explore new research and reform solutions, so that it is more effective in teaching.

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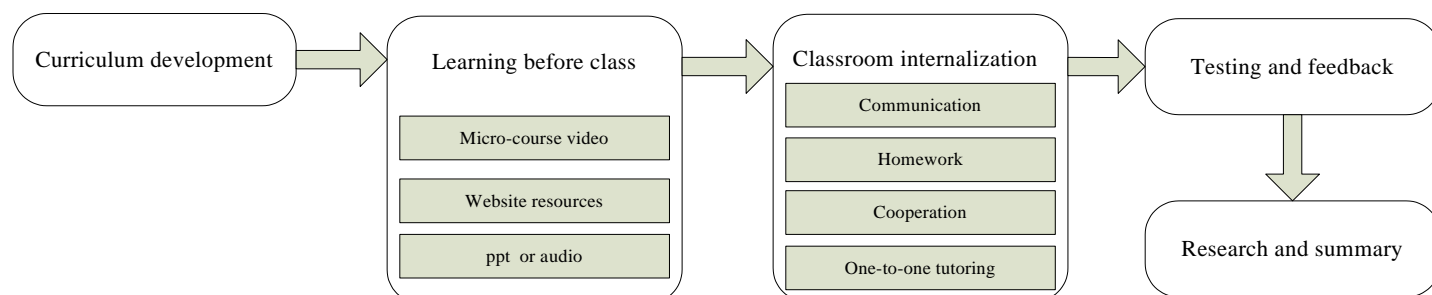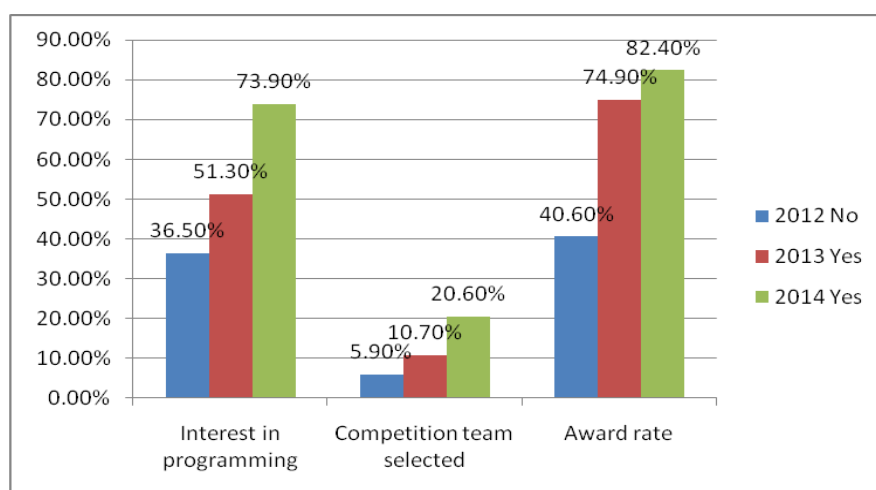
Fig. 6.   Teaching mode of "Flipped Classroom"

Fig. 7.   Statistical analysis