ATLANTIS PRESS
Advances in Intelligent Systems Research, volume 130
6th International Conference on Mechatronics, Computer and Education Informationization (MCEI 2016)

Research on Educational Reform of Java Programming

Limei Cui
School of Information Engineering, Qujing Normal University, Qujing, China
756612367@qq.com

Keywords: Java; Object-oriented; Educational reform; Online Judge; Project design

Abstract. As an important professional basic course, Java Language Programming is designed to train students about object-oriented programming ideas and application of technology. In practical teaching process, we summarize the problems existing in the traditional JAVA Teaching and put forward specific teaching reform ideas, such as using Judge Online CAI system to train students' practical ability, attaching importance to curriculum designs, and strengthens practice by project-driven, which mostly improves the teaching effect.

Introduction

Java programming is the core of professional basic course in most university of computer specialty, and has strong ductility [1]; the follow-up courses are JSP, J2EE and Android programming, so we must strengthen the basic skills of the course's practice in order to enable students to master Java programming techniques better. The course's educational reform has been carried out widely, and has achieved fruitful results. Some teachers put forward new three stage educational reform of foundation, practice and subject participation[2, 3], it has good teaching significance, but for the project participation mentioned in the literature, only involved in a few college students, is not conducive to the common progress of all college students. Some teachers pointed out single task driven teaching mode in Java teaching [4, 5], but the discussion of basic theory of the teaching process is not enough.

Based on years of teaching experience, the author of the article explores the thought and measures in educational reform against the current problems of Java teaching.

Problems Existing in the Traditional JAVA Teaching

The Old Teaching Plan Makes College Students' Lack of Confidence. The course itself is a complete system, including leading and follow-up courses; curriculum knowledge involves a wide range of content, cramming education makes students passive learning in order to complete the teaching task, which leads to a negative attitude and loses interest in learning gradually; students don't know how helps future work of content in class, which makes them without clear learning objectives, students only learn what the teacher taught makes them lack of self-learning ability and assiduous study; the students master the knowledge and skills rigidly makes them impossible meet the requirements of creative work. Students can't combine the course and simple system design, so they don't know what practical problems Java programming can solve in the end. In addition, because of the traditional content is too simple, also caused the students' practical ability is weak in solving the problems related to computer.

Teaching Inspection Feedback Mechanism Lacks of Innovation Makes Inefficiently Teaching. Marking program must not make do, the author thinks that the marking result can only be "right" or "wrong", it's because the engineering characteristics of the program, strict requirements for students can also develop their future work in earnest attitude. The review of standard can be reduced to the level, such as the criterion for judging correct is compiled by, entering a reasonable test case can get the correct results. Completion of homework can better feedback the students' master degree, then teacher can dynamically adjust teaching progress and way. At present, students submit the electronic file; teachers mark them randomly, so the overall situation students grasp is not comprehensive. This is worthy of in-depth discussion, the purpose of programming is to

simplify the workload, but such course's teachers face such an embarrassment, shows inefficiency.

Practice Training Is Insufficient, Engineering Ability Is Weak. Java programming is divided into two parts, theory and Practice Teaching. Theory teaching basically focus on the grammar and program structure with simple programming skills, practical teaching basically focus on the verification experiment, this kind of traditional teaching method completely according to the teacher's steps, can not effectively arouse students' enthusiasm and interest, is not conducive to the cultivation of computer majors ability to solve practical problems. In practice, the whole teaching process usually adopts a virtual project such as the "XX project design and implementation", Java open resources and reference book resources involves them, even the whole software development background, design process, implementation process, implementation of all source code are available. These virtual projects are mostly self determined, rather than the actual development requirements of the actual user. Students are anxious to complete the project, and only focus on the implementation of the system, started as writing code, don't pay attention to system analysis and design according to the software engineering theory, also class design and their relations, and don't communicate with end user, lack of opportunity to repeatedly modify the system function. All these lead to students' engineering ability too weak.

JAVA Educational Reform Ideas

Focusing on Improving Class Efficiency, Cultivating Object-Oriented Ideas. Before the Java courses, students have generally studied C program, and have certain ability of programming. So teachers should not waste time in the basic grammar, but focus on the cultivation of the object-oriented ideas to improve class efficiency.

Object-oriented Model design is very important, by learning some simple design patterns such as simple factory pattern, strategy pattern, subscriber/publisher pattern, singleton pattern and adapter pattern[6, 7], can make students understand better object-oriented program design essence. Also students understand better the principle of object-oriented design, such as the principle of opening and closing, the single responsibility principle, the dependency inversion principle, Liskov Substitution Principle and synthesis/polymerization Reuse Principle [8, 9]. Application of simple factory pattern in teaching is as shown below.

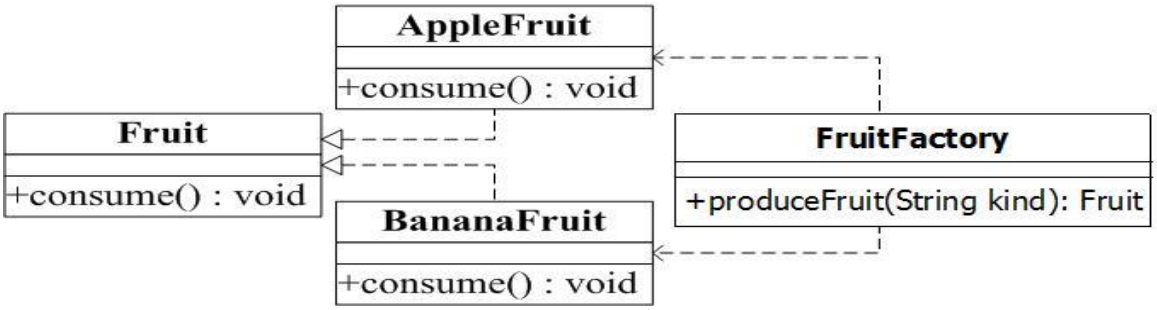

Figure 1. Simple fruit factory pattern

Cultivating object-oriented idea is difficult point, because students have been accustomed to the idea of machine centered programming. This requires repeated practice, for example, through time class, complex class, fraction class and matrix class can gradually make students understand basic principles and techniques of object-oriented. At the same time, teachers can also compare the "data structure" course, for example, each type of data structure has data storage definition, initialization, operation and memory release, like object-oriented programming in the member variables, constructors, methods and destructor [10]. Through this comparative study, students can not only deepen the understanding of the lateral knowledge, but also can better understand the principle of object-oriented.

Using Judge Online CAI System to Train Students' Practical Ability. Conventional teaching feedback is to do the homework, due to the particularity of the program; marking program is a real

grind, time consuming and not necessarily accurate. Teachers gave assignments on Online Judge CAI system, students submit source code through the system, computer automatically judge and show feedback results, students can repeatedly improve and submit the program according to the prompt if error. Teachers can follow the path of the students' submission to understand the students' learning status. This method can better motivate students' subjective initiative and cultivate students' practical ability.

Attaching Importance to Curriculum Designs, and Strengthens Practice by Project-Driven. The development of a series of design, integrated curriculum design is difficult then verification experimental work mentioned above, so it's useful for students to contact some small project development. The difficulty of the project is flexible according to the grasp knowledge of students' situation, avoid too much emphasis on workload and skills, after all, the purpose of teaching is to allow most students benefit. In addition, it should be that each student is a group, each person completes the project, using of collaborative projects will lead to some students appear free rider phenomenon. The difficulty of curriculum design lies in the inspection of students' complete task, at this time, students can form a group; the same group of students learns from each other to demonstrate the respondent, and pick a good student to make presentation in class, it can greatly cultivate students' self-confidence and the ability to study intensively through the activities. Example of project design for the main teaching content is as shown below.

Table 1 The project design of the course's main content

Curriculum system	Learning content	Practical programming
Introduction to Java programming	Develop simple Java application	HelloWorld
Control statement	Conditional and loop statement	Simple factory mode (to achieve the calculator console program, etc.) / strategy mode (to achieve the farm management system, etc.)
Class and object	class and object declare , initialize and use, Encapsulation	
Inheritance and polymiorphism	Parent class, child class and polymiorphism	
Interface	Define and implements interface	
Exception	Catch and handling exception, throws exception	
Java Applet	Draw graphics, insert animation and sound	"Java programming" university-level key course management system (with login and query, file upload and download, teaching video playback)
Database programming	Access data stored in MySQL	
File accessing	Access sequential file and random file	
Thread	Life cycle of thread, priority and multithreading	concurrent execution
Socket	Connection based communication	Connection oriented communication

Conclusions

The teaching practice shows that weakening of explanation of basic grammar can have much time to strengthen the cultivation of students' object-oriented ideas; in practical teaching increased a series of simple system design based on project-driven, and each person as a group, so that every student can really participate in and get the exercise, greatly enhanced their confidence. Students master learning methods of the object-oriented language through the course of study; enhance their ability to study independently in the future. The use of the Judge Online system makes the teacher liberated from the heavy homework correcting, and the interactive homework correcting method has been widely welcomed by the students.

References

[1] Information on http://www.tiobe.com/index.php/content/paperinfo/tpci/index.html.

[2] Y. Huang, J.Y. Wang. Three-stage Teaching Method for Java Language Programming Design: Computer Education, (2011)No.14, p.55.

[3] N. Li: Study on Java teaching based on driving with project and task, Journal of Jiamusi Education Institute, (2012) No.4, p.107.

[4] J. Bloch, Effective Java, second ed., Phei, Bei Jing, 2016.

[5] W.Z. Shen, Z.H. Su and J. Zhao: Application of Project-driven Pedagogy in Teaching of Java Language Programming, Journal of Northeast Agricultural University(Social Science Edition), Vol.8 (2010) No.2, p.66.

[6] D. Qiu, B.X. Li and H. Leung: Understanding the API usage in Java, Information and Software Technology, Vol.73 (2016) No.11, p.11.

[7] J. Sawin, A. Rountev: Improving static resolution of dynamic class loading in Java using dynamically gathered environment information, Automated Software Engineering, Vol.16 (2009) No.2, p.357.

[8] R.J. Colvin: An operational semantics for object-oriented concepts based on the class hierarchy, Formal Aspects of Computing, Vol.26 (2014) No.3, p.491.

[9] X.C. Pan, Java Programming, Tupwk, Bei Jing, 2010.

[10] P. Deitel, Java SE8 Programming, third ed., Phei, Bei Jing, 2016.