The Construction and Practice of JAVA Programming High-quality Course

Xiao-Ping XU¹,a,*, Ying-Yu YIN¹,b, Wen-Guo WEI¹,c and Jun CAI¹,d
¹Guangdong Polytechnic Normal University, Guangzhou, China
a cathy.xu@163.com, b yinlizheng@21cn.com, c wgwei@21cn.com, d gzhcaijun@gmail.com
*Corresponding author

Keywords: JAVA Programming, High-quality Course, Construction.

Abstract. JAVA Programming is a compulsory course of computer, electronic information and related majors and widely applied in the industry. The paper has introduced construction contents and results of high-quality course JAVA Programming. After construction of dozens of years in several stages, we have built course system with application characteristics and multi-layered experiment training system to make it high-quality course in the university and then high-quality course in Guangdong Province. Currently, we are building national high-quality course, providing reference for construction of related high-quality course in the same industry.

Introduction

JAVA Programming has always been the compulsory course for all majors of Telecommunication School of the university since establishment in 2000. After construction of dozens of years in several stages, we have built course system with application characteristics and multi-layered experiment training system to make it high-quality course in the university. Afterwards, we built diversified networked aided teaching means to be rated as university-level high-quality course. We further implemented teaching reform, updated teaching methods, expanded teaching forms, enriched teaching resources and improved ourselves during reform to make high-quality course in Guangdong Province. Currently, we are building national high-quality course.

Construction Contents and Results

Establishment of Course System with Application Characteristics

At the beginning of course establishment, we have built course system with application characteristics according to school-running orientation. During teaching practice, we have adopted course system composed of theoretical teaching, online verification experiment, integrated course design and project internship to increase opportunities to practice and cultivate ability of practical application [1]. In the meanwhile, as the school-teaching major includes network engineering, communication engineering and electronic engineering and school-teaching grades and course nature are different, with great difference in students’ knowledge structure. Hence, we have put forward distinct teaching according to cultivation objective of different majors and adjusted course system to adapt to demand of major and non-major levels and prepared corresponding course outlines and experiment outlines to satisfy demand of talent cultivation of different majors.

Course Orientation and Course Objectives

We establish course system as well as experiment and training system and take them as orientation and objectives of teaching reform according to requirements in the school’s school-running orientation namely “target at vocational education, serve vocational education and lead vocational education”.

410
JAVA Programming is the main compulsory computer basic course for students of all majors in Telecommunication School and it is also the key course of computer basic education. The course has been set in our school for 11 years and there are 8 undergraduate programs establishing this course and it becomes compulsory professional basic course. The purpose is to lay solid programming foundation for students in subsequent learning of related courses of computer and specialized courses and make full preparations for students to participate all kinds of computer examinations.

Teaching objectives of this course is to enable students to grasp JAVA language foundation as well as essential knowledge and tools of programming, to grasp thought and methods of object-oriented programming, to apply JAVA technology in development of application program and to preliminarily possess basic abilities that a software developer shall possess, thus laying solid foundation for study and related work in the future. This course is oriented by cultivating students’ learning interest, problem solving and programming ability as well as exploration and innovation spirits and it can improve students’ interests in programming and ability in comprehensive programming, thus making students possess awareness and ability to solve problems with the help of computer in all professional fields.

Key Points, Difficulties and Solutions of the Course

The key points and difficulties of teaching include object-oriented design philosophy; understanding and use of class object; study and application of inheritance and realization as well as rewriting and reloading; understanding and application of input/output, abnormality and thread; design of graphic interface etc. According to difficulties and key points of teaching in this course, we have taken the following solutions:

Discuss. As for difficulties and key points of teaching in this course, teachers collectively prepare lessons, discuss together and put forward solutions.

Explain. In class, multimedia, demonstration and other methods are adopted to explain key points so as to deepen memory of students. After class, corresponding auxiliary materials, exercises for each chapter will be supplemented. On one hand, students can take advantages of multimedia teaching such as large amount of information, vividness and easiness in understanding. On the other hand, they can learn all contents of class teaching and the materials for students’ self education are increased so as to help students in understanding and grasp of important contents.

Example. As for difficult contents, the method of “explaining profound theories in simple terms” will be adopted in explanation and examples will be used for illustration so as to solve problems that students find it hard to understand. Analyze program structure and programming thought step by step from simple points to difficult points. Besides, the method of combing classroom teaching with after-class self study, combining course interaction with online answering question and combing classroom case with experiment items so as to help students in digesting and understanding difficult contents of classroom teaching.

Establish Multi-Layered Experiment and Training System

Due to requirements of course system, we also established a multi-layered experiment and training system so as to reach the target of cultivating talents of technology application, enhancing training of application ability and finally enabling students to comprehensively grasp relevant knowledge, thus applying their knowledge. We have established and improved the multi-layered experiment and training system including different internship and practical training such as computer experiment, course design, semester project, course internship etc. so as to coordinate classroom teaching, quickly apply learnt knowledge into practical application and lay a solid foundation for the work in the future. We have also organized research measures for teaching and researching activities, put forward targeted experiment teaching plan and scheme and compiled relevant teaching programme for experiment, training and internship for different experiment steps, thus solving experiment and training problems in all levels of the course, providing verifying, comprehensive, design-typed,
innovative and practical experiment platforms for students, cultivating students’ engineering practice ability and innovation ability and further improving overall teaching effects.

**Design Philosophy of Practical Teaching Activities**

The practical philosophy of JAVA Programming is aimed at cultivating talents of technology application, enhancing training of application ability and finally enabling students to comprehensively grasp relevant knowledge, thus applying their knowledge. Therefore, we have established the multi-layered experiment and training system including different internship and practical training such as computer experiment, course design, semester project, course internship etc. so as to coordinate classroom teaching, quickly apply learnt knowledge into practical application and lay a solid foundation for the work in the future. We have designed targeted experiment teaching plan and scheme and compiled relevant teaching programme for experiment, training and internship for different experiment steps, thus solving experiment and training problems in all levels of the course, providing verifying, comprehensive, design-typed, innovative and practical experiment platforms for students, cultivating students’ engineering practice ability and innovation ability and further improving overall teaching effects.

**Objectives and Effects of Practical Course**

Objectives of experiment course of JAVA Programming are: to enable students to have practical experience of contents explained in class, deepen the understanding, grasp and application of concept, thought and technology, motivate students’ further thinking and performance and pay attention to cultivating students’ learning interest and innovative thinking. By means of experiment, students understand and grasp basic though and methods of Java programming; students are able to proficiently use development tools to write program and debug program; students have learnt object-oriented programming method; they preliminarly grasp application and development related to Java; and they also possess a certain design and programming ability of software system.

Years of practical teaching indicates that the manipulative ability and practical application ability of the students has been obviously improved and the understanding for the classroom teaching of the students has been deepened and it has reached the expected objective of the experiment training course. Many students can carry out the development of the related software system which greatly improves the interest and enthusiasm in study of the students. The majority of students have passed the National Computer Rank Examination Band III and IV and got good grades in various network programming contests and obtained such related authentication certificates as the JAVA Programmer and also undertaken the website construction work of most key courses, excellent courses and high-quality courses of the college and the results are obvious.

**Organizational Form of Practical Courses and Teacher's Guidance Methods**

Practical teaching of JAVA Programming consists of three parts: “online test”, “course design” and “term project”. Among them, online test is a kind of proving test which is corresponding to the classroom teaching contents and the period with the theoretical teaching is 1:1; course design is a kind of design test through which the students can develop small application with comprehensive application of the learned knowledge; the term project is a centralized practice for 2 weeks which is jointly completed by the main teacher and the cooperative corporation. It belongs to application and developing test which targets an actual project. The whole class in groups will undertake the development of the subsystem respectively and finally the research and development of a project will be completed. The guidance method of the experiment is to take students practice as the primary thing with the assistance of teacher’s guidance and to lead the students to complete the experimental goal through the task-driven method.
Evaluation Contents and Methods of Practical Courses

The evaluation contents consist of three parts, namely checking-in discipline (10 points), online test (40 points) and course design (50 points). The grade of the online test is scored in accordance with the completion performance of the experiment and writing of the experimental report; the course design is scored in accordance with the specific performance of the experimental pleading, experimental result and code quality. The experiment score of the students accounts for 30% of the total score of the whole course.

Establishment of Multiple Networking Auxiliary Teaching and Experimental Environment

With the development of multimedia technology and computer networking technology, we have established multiple networking auxiliary teaching to coordinate the teaching of the courses. We have established multiple teaching and experimental environments and carried out the networking auxiliary teaching of courses. We combine the traditional teaching methods with the modern educational technological methods through the modern educational technological methods and the application of the multi-media classroom for classroom teaching. With the campus network being the medium, we have designed and developed an efficient and practical integrated platform for course teaching. All electronic teaching plans, such teaching steps as homework, experiments and questions answering can be supported at this platform which also provides abundant network course teaching resources download and establishes a multiple teaching supporting environment which is convenient for the interaction between the students and teachers and meets the personalized independent study and inquiry learning of the students to the benefit of the cultivation of innovation ability.

Comprehensive Application of Multiple Teaching Means

Comprehensively apply multiple teaching means, including traditional teaching, multimedia teaching and network teaching to improve the teaching effect.

Adopt Multimedia Means for the Classroom Theoretical Teaching. The modern educational technology means is adopted for the theoretical teaching. The multimedia courseware is made and introduced for all courses to vividly express the abstract and complicated contents and help the students clearly understand the teaching contents and stimulate the learning interest of the students. For the important and difficult parts of the course, the demonstration with graph, image data and simulation is adopted which is convenient for the understanding and learning of the students. The multimedia courseware is well organized with large amounts of information and it is easy to be updated with obvious teaching effect and is good for classroom theoretical teaching.

Combination Conventional Teaching Advantages and Application of Modern Educational Technology Method all at once. We actively apply modern educational technology and at the same time combine it with conventional teaching method and means, drawing on each other’s strength and mutually supplementing. Based on different teaching contents, such as some problems in comprehensive programming and system design samples, students’ thinking process is needed, and conventional teaching method is more beneficial to enhance the understanding of students, and therefore, currently we still write on the blackboard to allow students to simultaneously think along with the teaching by teachers, resulting in better effect.

Application of Diversified Network Teaching Means to Support Independent Study of Students. We has established diversified teaching and experimental environment to carry out network-assisted teaching of courses and support the independent study of students in order to match up with the classroom teaching of the Course. We take the campus network as medium to design and develop an efficient, practical and integrated course teaching platform by which all electronic teachings plans, schools assignments, experiments, questions and answers and all teaching links are supported, and from which relatively abundant network course teaching resources can be downloaded, establishing diversified teaching support environment for students to personally and independently study and explore, and thus it is beneficial to foster their innovation ability.
Development of an Efficient, Practical and Integrated Course Teaching Platform

We take the campus network as medium to design and develop an efficient, practical and integrated course teaching platform, establish diversified teaching and experiment environment and implement the network-assisted teaching of course. It is convenient for students and teachers to interact with each other with abundant teaching practice resources, and these resources allows students to personally and independently study and explore, which it is beneficial to foster their innovation ability. Main features are as follows:

**Abundant teaching resources.** We provide abundant network tutoring resources related to classroom teachings, including syllabus, teaching plans, teaching courseware, classic samples, simulation examination paper, experimental guidance, experimental platform and teaching video in order to match up with the classroom teaching of the Course, and all electronic teachings plans, schools assignments, experiments, questions and answers and all teaching links are supported by the platform in which there is a resource sharing center providing abundant network course teaching resources allowable for downloading, meeting all students’ needs of independent study, after-school study and knowledge enlargement. In addition, the introduction to the teaching, including teaching characteristics, teaching conditions, teaching contents, teaching methods, teaching means, teaching reform, teaching innovation and teaching effect are provided on the website to allow students to understand something about the teaching of course they are learning.

**Emphasis on practical teaching.** We introduce the practice system characteristics to students online, provide relevant experiment outlines, practical training outlines and internship outline, different experimental links in coordination with the need of classroom teaching, targeted experimental teaching plans and schemes, including computer experiment, semester project, course project and enterprise project training to provide students with verification-type, design-type, innovation-type, integration-type, application-type and various experimental platforms, solving problems in experimental and practical training teaching at all levels of the Course, and therefore the teaching quality is significantly improved.

**Interactive, explorative and independent study.** The independent study platform, interactive teaching, online test and examination and online question and answer are provided on the website for the interaction between students and teachers and meeting students’ need of personal and explorative study, to encourage and support students to independently study and think; diversified teaching support environment is beneficial for students to foster their innovation ability.

**Implementation of Bilingual Teaching Model Reform**

As the excellent course construction progresses, we further promoted teaching reform and start to try the bilingual teaching model. Methods include adopting internationally authorized photocopied English textbooks, teaching bilingual classes and organizing English-only examinations etc. Besides, the students are required to finish their homework using English, which has obtained pretty good effects. We also employed teachers abroad to be course speakers. Thus the students are fostered to be international talents under the foreign teaching and fostering models. The students will also participate in internationally professional accreditations to further improve their practice and employment abilities.

**Adoption of Advanced Teaching Methods**

Advanced methods adopted in teaching include “task-driven teaching” “project teaching” and “behavior-oriented teaching” methods etc. For example, in the teaching practice process of the course JAVA Programming, by adopting the “task-driven” teaching method, combined with detailed teaching cases and the application and research teaching model, the students can analyze and discuss on the tasks, define the involved knowledge and find out the solutions under the direction of the teachers. Therefore, the students will be equipped with both solid theory foundation and proficient practical operation skills. In the practice link of the semester program, by adopting “project-teaching” method, the students’ abilities in analyzing, understanding and programming programs can be
trained; they can also conduct real application development and design by making comprehensive use of the theory knowledge of relevant courses, thus greatly improving their applied programming abilities.

In theory teaching, by adopting discussion and research teaching method in place of the way where only the teacher talks all through the lesson, accompanied with methods including inspiration, discussion, students demonstration and teacher commenting etc., the students can be led to actively and proactively think, thus improving their abilities to analyze and solve problems. Through introducing the teaching contents to be discussed using classic cases and asking problems designed by the teacher and then leading the students to discuss and finally reach the answers, the students’ initiatives can be greatly inspired, which shall make them have a sounder mastering over knowledge. This way of learning can impress the students, promote their interests to participate in and liven the atmosphere on the course.

In the practical teaching, by adopting “task-driven” teaching method, combined with detailed teaching cases and requiring the students to conduct in the form of research groups, the students can analyze and discuss the task, thus they can define the involved knowledge, find out the solutions under the direction of the teacher and even develop small applications using the learned knowledge. Through this practice, the students can master the methods, thinking ways and abilities to analyze and solve problems and improve their comprehensive qualities and application abilities during learning, which have result in pretty good effects.

In term project practice, adopt teaching method of “project teaching”. Term project is centralized practice for 2 weeks, completed by teacher and cooperative enterprises together. Being application developmental practice, it has a practical project as the objective, with all the class divided into groups who undertake development of a subsystem each to ultimately complete research and development of the project. Guiding students in completing experimental objective by method of project teaching is similar to the practical research and development environment, which helps students in cultivating practical application programming ability, thus prompting employability of students.

Co-running School with Enterprises

To further improve employment competitiveness, we carry out co-running school with enterprises widely to complete training and practice projects together [3]. With authorized certification from enterprises, and cooperation with Guangzhou Sipu Computer Technology Company, provide students with certification training and certification examination for “JAVA programmer” improving practical ability and employability of students. Additionally, with support from cooperative enterprises, motivate learning enthusiasm in students by means of holding programming competitions and other means to promote course learning.

Summary

After construction of dozens of years, JAVA Programming had become a high-quality course in the university in 2012 and high-quality course in province in 2013. Dean of School of Computing of South China Normal University and Doctoral Adviser Professor Tang Yong commented that course team of JAVA Programming in School of Electronic Information of Guangdong Polytechnic Normal University is a teaching team with high academic level and rich teaching experience, which has been insisting on teaching reform and research and has achieved many achievements. By carrying out evaluation activities for teachers, Teaching Supervision Group of the university commented comprehensively on teaching of Principals of the course that, with wide professional knowledge, adopt multimedia assisted teaching in teaching with fully prepared teaching methods, clear teaching objectives and strong pertinence to professional knowledge. Thus, Total score is 91. Students commented that with rich teaching contents, focused key points, distinct arrangements and theory-relating practice, highlight cultivation of innovation ability and manipulative ability. Flexible
and varied teaching methods and proper teaching methods are adopted to highlight cultivation of ability and quality. Average result from comprehensive statistic on teaching evaluation for recent three years of JAVA Programming from students is 89 points. Currently, we are building national high-quality course.

References

