The Reform Research on Programming Courses of Computer Major

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\textbf{Abstract.} In this paper, we first analyzed the course setting of programming in computer major and discussed the problems that exist in the computer programming course, then we put forward a course integration scheme according to the actual situation and the thinking of teaching reform, so as to improve the quality of the program design course teaching and cultivate the students’ innovation ability.

\textbf{Introduction}

Program design course at the core of university computer professional courses, the purpose of this course is to train students grasping correct program design methods and ideas. After learning this course, students should not only master the knowledge of high level language program design, more important is to grasp in practice application design ideas and methods, and then get into the habit of independent thinking and ability to solve practical problems using the computer. It is a solid foundation for subsequent computer courses, such as data structure, operating system, software engineering, etc. Therefore, the programming language teaching will affect the application of computer in students’ professional career directly. Programming courses are usually based on a certain programming language as the teaching language. Along with the development of the program design technology and language, teaching languages used in the history include Basic, FORTRAN and Pascal, etc. At present we mainly use C programming language which is procedure oriented, C++ and Java which are object oriented programming language. C++ and Java become the mainstream programming language [1].

At present, most domestic colleges and universities choose the programming language according to their specific situations. By investigation, some domestic universities choose programming language as shown in Table 1.

\textbf{Table 1. The Setting of Programming Languages of Some Universities.}

<table>
<thead>
<tr>
<th>Programming Language</th>
<th>Semester</th>
<th>Hours</th>
<th>Course Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>C Language</td>
<td>1 or 2</td>
<td>51+32</td>
<td>Compulsory</td>
</tr>
<tr>
<td>C++ Language</td>
<td>4 or 5</td>
<td>51+32</td>
<td>Compulsory</td>
</tr>
<tr>
<td>Java Language</td>
<td>6</td>
<td>36+34</td>
<td>Elective</td>
</tr>
</tbody>
</table>

From Table 1 we know that most universities open an \textit{Introduction of Programming} course in the first or second semester, the course generally use C as teaching language. The class hours may be different, generally 3 hours lectures and 2 hours labs a week. The main teaching content include: data types, operators and expressions, statements and control structures, arrays, functions, pointer, structure and union, file operations, etc.

After opening the \textit{Introduction of Programming} course, some university also open a course C++ programming language or Java programming language. This is usually given in the 4th or 5th semester. These two courses mainly discuss object-oriented programming methods and ideas. Some
other schools may have other arrangements, such as take Visual Basic as the first courses to introduce programming, then C or C++, etc.

The Problems Exists in Programming Course

According to the above discussion of the program design scheme of teaching curriculum, there exist many problems in practice.

The Contents Repetition and Lack of Depth

To learn fundamentals of programming using one programming language (like C), to learn object oriented programming using another programming language (C++ or Java) will results in repetition of the course contents. In these courses, teachers usually start from the basic grammar, so results in the limited hours, students just learned the basic knowledge of the language, not in-depth study. Many students often have such feeling, "learned so many programming language, but master none". The reasons for this phenomenon is the school has set up many different programming languages, within the limited class hours, teachers can't teach the language in depth, the result makes students have no thorough understanding and master a programming language.

The Colliding of Procedure Oriented and Object Oriented

C is a procedure oriented programming language, C++ and Java are object-oriented languages. Object-oriented programming and analysis methods have been considered to be effective methods of software development. The most important purpose of programming course is to enable students to master the object-oriented thought. If students first learn C language, then learn object oriented language, the transformation from the procedure oriented to object oriented thinking will be very difficult. Using object oriented programming language, the minds of students will be constraint to the procedure oriented thinking. This experiment were carried out in foreign countries, and the conclusion is: students without programming experience may be faster and more effective to learn object-oriented programming than those who already have procedure oriented programming experience.

In history there are many programming languages, some are suitable for practical application, some are suitable for teaching. Procedure oriented programming language mainly used in large engineering calculation or in order to do a complete task or calculation. And object oriented programming technology reduced the complexity of software development; it can be used to develop software with high reliability, reusability and ease maintenance, to improve the efficiency of software development.

The Integration Scheme of Programming Course

The key points of programming course teaching do not lie in how to solve various practical problems, but in how to master the usage of high level programming language to write practical program, so as to learn the courses in the future such as programming language theory, algorithm design and analysis, programming methodology.

Reduce the Duplicate Course Contents

In order to improve the efficiency of teaching and learning, we should minimize the duplicate contents in language teaching. The common contents in different languages should be taught in introduction course; those contents should be omit in later courses. For example, if the students first learn Java, then learn C, so the operators, expressions, control structures in C should not be taught in detail. In this way, students will have more time to accept new knowledge, that will stimulate students' learning interest and improve teaching efficiency.
The Object-Oriented First Methods

Constructivists believe that teaching can't ignore the existing knowledge of the learners. The knowledge learners obtained should be taken as a new growing point of knowledge, they will guide the learners to grow from the original knowledge to new knowledge. Research has proved that students who have a lot of knowledge about structured programming are hard to learn object-oriented programming. The transformation from structured method to object oriented method is not as easy as from Basic to Pascal, or from Pascal to C. Therefore, many scholars proposed in learning programming language we should adopt the object-oriented first method, namely students should learn object-oriented programming first, then learn procedure oriented programming. This practice has implemented in some universities abroad, for example, in University of Ballarat in Australia, their first programming courses for the students is Java for the first year, and teach C in the second or third year, C is used for special purpose or for embedded development.

The integration of multiple languages

According to the survey in October 2015 of TIOBE, the top 10 most popular programming language is: Java, C, C++, C#, Python, PHP, and Visual Basic .NET, JavaScript, Perl and Ruby. Some of these are common used languages; they are suitable for one aspect application. Students choose to learn them according to their own development direction; schools should also set a reasonable solution according to training objectives. Based on the above analysis, we can design a curriculum plan as shown in Fig 1.

Figure 1. The Integration of Programming Courses.

Assume that the knowledge of programming of computer major students should master represented by rectangular area, the area can be divided into four parts: basic part is a common language features of various languages, which include data types, the basic control structure, classes and their using, etc. This part can be learned in the lower grades. Later, according to the training objectives of different schools to determine the C++ series (including C) and Java series (including C#).

Finally, in the advanced course, which emphasize on the study of programming theory, the students can earn the ability on independent extension and programming in high-level programming language with the support of other courses. According to the foregoing discussion, we think that it is more appropriate using Java as the basic parts. On the course hours, we should arrange according to the actual situation. The basic parts, the teaching hours may be 54~64, other parts of the teaching may be about 60 hours [2].

The Introduction Language Problems

The first programming language has a great influence on the follow-up courses. Through the investigation of author, we think it is better Java as the introduction language. The Java is a language which has the following features: object-oriented, simple, independent of platform, application in many ways and become more and more popular. It has the characteristics of most modern languages. Therefore, the language is the perfect introduction language. The author has made a survey get the result who thinks Java language can be as a first language accounted for 62.3% [3].
About Object-Oriented

The object oriented method is the prevailing programming paradigm. C++ is a superset of the C language, it has both the features of object oriented and procedure oriented, and many of its features are very complicated, therefore, it is not suitable as an introduction language. Java is a pure object-oriented language. By learning the Java, it is easier to understand the thoughts of object-oriented, students can quickly grasp the basic features of object oriented programming. For example, about the class definition and using, encapsulation, inheritance and polymorphism, etc.

The Relationship between Java and Other Courses

If we use Java as the introduction language, we must consider the languages used in other courses, such as Data Structure, Operating System and Computer Network.

First, if we use C language to implement the algorithms in data structure course, because C lack of classes, students often feel difficult and even students can master the thought of the algorithms, they can’t write a program using C language.

Firstly, if students know Java language, when learning data structure they can use the data structure textbooks written in Java. The algorithms implemented using Java are easy understood and far more intuitive than using C language, and that can also to improve the teaching effect.

Secondly, in the subsequent Operating System course students should have knowledge in about high-level language. Teachers can also use Java to teach the implementation of the operating system [4].

Thirdly, some students may take the entrance exam for postgraduate, Data structure, Operating System, Principle of Computer and Computer Network are the courses of the exam, and students can use Java to answer the questions because the exam outline specified questions in Data Structure can use C, C++ or Java.

Conclusions

In this paper, based on the status of computer programming courses and the questions exist, we designed an integration plan about programming course and proposed the selection problem of introduction programming language of computer major. In order to adapt to the requirements of era, the choice of computer programming language and teaching must be done along with the development of era, and should not stand still. Java has many advantages as an introduction language in program design course, with it as an introduction language, along with good ideas of other languages, students can master programming skills better and faster, it will lay a solid foundation for learning other courses of computer science.

References


