

Exploration and reformation of teaching methods for “Data Structure” course

Liu Na¹ Lu Ying¹ Yao Chun-long¹

¹ School of Information Science & Engineering, DaLian Polytechnic University, DaLian

Abstract

“Data Structure” is a compulsory course for computer undergraduate students. But due to course content abstract, traditional teaching methods is difficult to make students to master the main content of the course, so as to cause students to lose interest in learning and teaching effect is not ideal. According to the above problem, this paper puts forward case teaching method, comparative and inductive teaching method, heuristic teaching method and predictive teaching method. Practice has proved that the reform of teaching method can improve the learning efficiency of students and enhance learning interest.

Keywords: Data Structure; case teaching method; comparative and inductive teaching method; heuristic teaching method; predictive teaching method

“Data Structure” course is a computer science professional core courses, plays

an essential role in the computer curriculum system, it not only can provide the follow-up professional courses with the basis of the theory and practice, and other computer science courses, such as operating system, compiling principle, etc are closely linked.

The goal of “Data Structure” course is mainly to cultivate students with reasonable and effectively organize, store and process data, correct the design algorithm, the ability to analyze the algorithm validity. Therefore, learning this course to improve the students' cognitive level and the ability to practice and theory has a very important role.

But because of its abstract and dynamic, “Data Structure” course unavoidably causes difficult to grasp the main content. The reform of “Data Structure” course teaching method is necessary.

This paper starts with the current situation of “Data Structure” course,

This work is supported by Liaoning province "Eleventh Five-Year" Education Science and planning issues (JG09DB018); Liaoning province ordinary higher education undergraduate course teaching reform research project ([2012]130)

finds out the main problems existing in the course, and puts forward a series of teaching reform methods.

1 Main problems existing in “Data Structure” course

After many years of teaching practice, we found that "Data Structure" course in the teaching process mainly exist the following problems:

1.1 Course content abstract

“Data Structure” course is a professional basic course, combines the content of the mathematics, computer hardware and computer software. The purpose is to make students can choose a suitable data structure and algorithm for practical problems. Its contents include logic structure, storage structure, searching and sorting algorithm, such as linear list, stack, queue, string, array, tree, binary tree and graphics and so on. Therefore, coverage of teaching content is wide, most content is relevant to algorithm, and the abstract of course content is very strong. Meanwhile, the logic data structure used in the textbooks is abstract data types, algorithms is described by pseudo code, which makes students understand difficulty. When facing some real problems, it is hard for students to find out logical data structure corresponding to real problem, also can not find out the corresponding algorithm

to solve the problem.

1.2 Teaching mode single

At present, “Data Structure” course in the teaching process is mostly using multimedia teaching way. Although this method is clear and convenient, because this course involves a large number of concepts, abstract data types as well as the algorithm. The algorithm can't be described in detail in the classroom, so that the students are difficult to imagine the complex relationships between data.

1.3 Practice ability weak

At present, most of textbooks use C language to describe data structure algorithm, especially point, function and struct in C language which is most difficult and worst part for students. So in the experiments, students often don't know how to transform algorithm into a computer program.

2 Discussion of “Data Structure” course teaching method

Based on the main problems existing in “Data Structure” course and textbook^[1], with student's study enthusiasm and interest as starting point, this paper puts forward the following solutions.

2.1 Case teaching method

Case teaching method is a kind of extremely potential teaching mode. It refers to teachers not only start with

definition or abstract data types, but also take some cases as the breakthrough point before teaching the new content^[2]. From the case, it can let students have a sensitive and specific understanding of teaching content, and then teachers can transit from case to principle and nature of problem easily. Because of interesting and instructive, the case always can inspire students to explore how to solve these problems, put up a bridge of understanding between problem and data structure, and reduce the difficulty of learning the content of abstract data.

The case that teachers select can be one or a few, but it must be closer to life, interesting and can be described by some kind of data structure. There are a lot of cases can be introduced into the “Data Structure” course in the teaching process. For example, at the beginning of “Data Structure” course, the effect of this course is not very clear. Then teachers can introduce telephone number query problem as a case. Telephone directory is the most commonly function of mobile phone. While finding a telephone number, we can in order to find in telephone directory, we also can accord the order of the names in Chinese pinyin. Obviously, some students consider the latter method is more commonly used, because the search efficiency is faster. At this point, the teachers can state that algorithm design also exist efficiency problem and how to design the high efficiency

algorithm is an important research content of “Data Structure” course.

Case teaching method can better combine theory and practice, eliminate strangeness of this course at beginning. Through analysis and discussion of case, it can help students to grasp the theory and practical application better, enter into the study of the course quickly.

2.2 Comparative and inductive method

Because of connection of knowledge points in “Data Structure” course, teachers can adopt comparative and inductive method in teaching process in order to make students to grasp each knowledge point^[3]. For example, linear list is the first logical structure, master the corresponding storage structure is a great help for future course of the study. After introduce sequential storage and chain storage, it can compare these two kinds of storage structure as follows: sequential storage structure is continuous storage space, chain storage structure is not always continuous storage space. Sequential storage structure has the advantage of random access elements, the disadvantage of moving a large number of elements when inserting or deleting elements. On the contrary, chain storage structure has the advantage of modification of pointer when inserting or deleting elements, the disadvantage of accessing element in turn.

We also can use comparative and

inductive method in the teaching of the stack and queue. Stack and queue have in common that both are special linear list.

The difference is that the former is first in last out while the latter is first in first out, which is shown as Fig. 1.

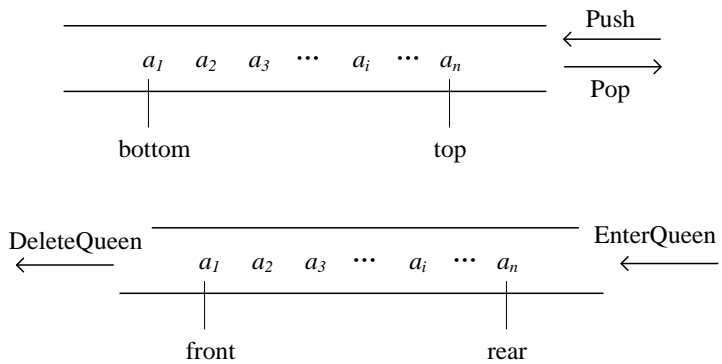


Fig. 1: Schematic diagram of stack and queue

Through such comparative and inductive method, students can more easily to grasp the main content of similar knowledge, the relevant content is also more easily to distinguish.

2.3 Heuristic teaching method

Heuristic teaching method is through the appropriate problems set in teaching, guide students to active thinking so as to improve the students' learning interest and initiative [4].

Usually, students take chain list as the most difficult content. Teachers can use heuristic method in teaching of this part. For example, when access element a_i in singly chain lists, teachers can inspire students that where is a_i ? Students will naturally think that the address of a_i stored in pointer field of a_{i-1} . That is, we

need to know the address of a_{i-1} . By this analogy, we need to know the address of $a_{i-2} \dots a_1$. How to express this process? Students will naturally think of $p = p \rightarrow \text{next}$.

The heuristic teaching method can cultivate the students' ability to analyze and solve problems, stimulate students' autonomous learning enthusiasm.

2.4 Predictive teaching method

Through the vertical and horizontal linkages, predictive teaching method can connect abstract content with real examples so as to mobilize students' learning enthusiasm and initiative, achieve obvious teaching effect.

For example, in order to help students to master the characteristics of stack and queue, teachers can associate pushing element into stack with putting books

into box.

Predictive teaching method can not only improve the students' imagination, active classroom atmosphere, but also make students to master new knowledge quickly, improve the effect of teaching.

3 Conclusions

“Data Structure” course is one of the important theoretical basis for computer and related professional courses, has an important role in computer science. But because of its abstract, traditional teaching is difficult to make students better grasp the content of this course, especially some difficulties in content, the students also feel difficult to understand. In order to solve this problem, based on the analysis of present condition of the curriculum of data structure, to stimulate students' interest in learning, cultivate students' practical ability is the main starting point, this paper puts forward four methods to improve the quality of classroom teaching data structure.

4 References

- [1] Yan Wei-min,Wu Wei-min. Data Structure(C) [M] . Tsinghua University Press,2010.
- [2] DONG Li-wei. Discussion on improvement of teaching methods in“data structure”course[J]. Journal of Shenyang Normal University

(Natural Science Edition), 2012, 30(2):307-309.

- [3] Fan De-bao,Yu Xiao-cong,Ding Wei-xiang. Improve the effect of data structure course teaching [J]. Heilongjiang Science and Technology Information, 2007, 17(1):194.
- [4] Tang Nian-qing,Wang Zai-rong. Analysis of Linear structure in data structure teaching [J].Neijiang Science & Technology, 2011(2):146-147.