

Reforms and practice in stratified teaching of a fundamental computer course in application-oriented universities

Kexin Zhang

Jilin Huaqiao University of Foreign Languages
Changchun, People's Republic of China

ABSTRACT: Based on computer-operating levels and features of freshmen in application-oriented universities, reforms were carried out in stratified teaching of a fundamental computer course, including *autonomic learning mode for students who need no teaching*, *teaching mode integrating class teaching*, *practice teaching* and *on-line teaching for students who need teaching* and *stratified teaching based on case studies*. Computer office automation examination for university students in Jilin Province was also introduced as part of the test for the course. By means of comparative analysis of students' grades in the entrance test, Grade-2 test of NCRE (National Computer Rank Examination) and final examination, it can be seen that reforms in the course have basically realised *teaching based on students' aptitude*.

INTRODUCTION

With the rapid development of computer technology and improvement of a student's computer literacy, a university student's ability is increasingly demanded in terms of computer knowledge, skill and application in the information-based society. Colleges and universities across China have carried out reforms to the teaching of fundamental computer courses for college students in non-computer majors in accordance with the guidance of *...To Further Enhance the Opinion of Computer Basic Teaching in Colleges and Universities and Basic Requirements on Computer Basic Teaching* (White Paper) proposed by the Steering Committee for Computer Course Teaching of Non-Computer Majors in Higher Institutions of the Ministry of Education in China and the *Requirements on Computer Teaching of Colleges* (6th Edition - 2011 Version) (Blue Paper) written by the Steering Committee of Fundamental Computer Course of Universities of the Ministry of Education in China [1][2]. Among these reforms, stratified teaching is being implemented in some colleges and universities.

ANALYSIS OF THE NECESSITY OF STRATIFIED TEACHING

Because of the popularity of computer education in recent years, fundamental computer courses are no longer limited to universities and colleges, but have begun to be applied in primary and middle schools. The economic condition of different regions, however, has led to an imbalance in computer literacy.

The computer knowledge level of students coming from developed regions or large and medium-sized cities has almost conformed to the teaching requirement of fundamentals of computers, while a lot of students coming from remote areas or underdeveloped regions are unable to receive systematic computer knowledge even though some of them have used computers before. Based on this condition, where the student's computer operating level is unbalanced when they are enrolled at a university or college, it is imperative to implement stratified teaching of fundamental computer course there [3].

Stratified teaching or teaching according to different levels, is a teaching method based on the theory of pedagogy and psychology. In stratified teaching, students are divided into different levels according to their practical situation. By taking the national teaching syllabus as a basic target, teaching targets of different levels are formulated according to the specific situation, and are improved step-by-step.

Students are divided according to their levels and grades, and also according to their current levels of competence, so that a hierarchy of student and teaching objectives will be formed. In addition, according to their learning status, the system of upgrading and downgrading will be implemented as this is a highlight of stratified teaching. For instance, Fundamentals of Computer is an obligatory course for all students.

If stratified teaching is implemented, students will be required to take an examination in computer operating skills at the beginning of their university/college life. Based on the academic performance in this examination, students will be divided into two grades (or levels) - an exempt programme or a compulsory programme, and students of each grade will be taught according to different teaching objectives in an effort to meet the requirements of application-oriented talent cultivation.

Stratified teaching, in fact, is affected by various factors, such as the characteristics of students, development and update of teaching methods, means and facilities, effective intervention of network teaching, etc. Drawing from successful experience of other universities and colleges, and in order to avoid the defects of over grading, the author has carried out reforms and practice on the stratified teaching of the Fundamentals of Computer course based on the application-oriented guideline.

In addition, the author has also found effective solutions for the phenomenon where students with a good foundation cannot acquire enough knowledge and where students with a poor foundation fail to keep up with the teaching schedule. To further implement this teaching reform, the teaching of the fundamental computer course should be application-oriented and should focus on students of different levels.

REFORM IDEAS OF STRATIFIED TEACHING

According to the investigation, it was found that many universities and colleges are confronted with such a problem in the teaching of fundamental computer courses - to teach students who have a good foundation in computer with more related knowledge and skills and to help students who have a poor foundation to reach the objectives of teaching of the fundamental computer course in the university/college. The stratified teaching of the fundamental computer course, which is set either for university or for the cultivation of application-oriented talent, can be divided into four parts:

- Students can be divided into two grades and be taught accordingly, after taking the computer operating level grade examination. Students with a good foundation can be exempted from the basic computer course, but are required to take the examination. Meanwhile, they can take any computer course as an elective course. As to the remaining students, stratified teaching will be adopted according to the previous requirements (they are required to take Fundamentals of Computer before taking other computer courses).
- The course hours are reduced from 68 credit hours or 56 credit hours to 45 credit hours, but the teaching quality remains the same.
- The integration of *classroom teaching*, *experiment teaching* and *network teaching* is realised in the computer classroom (computer laboratory). Students' autonomous learning is realised in the laboratory room via network with teaching after class.
- The assessment of students should be based on the final examination and the Jilin Province college student computer office automation examination, so that the assessment will be more objective.

In stratified teaching, students with a good foundation cannot only reach the highest level of the curriculum requirement, but can also take an extra computer course. Students with a poor foundation, however, can follow the teaching schedule and reach the basic requirement of the course. Students between both sides cannot only learn well, but can enjoy the learning process from the after-class type and improvement type cases. In this way, students will learn both in the class and after class, and will move from passive to positive learning. From appropriate case teaching, students' learning interest will be readjusted, and their internal driving force will be enhanced by network teaching platform and related cases.

STUDENTS OF THE EXEMPTION PROGRAMME LEARN THE TEACHING MODE AUTONOMOUSLY

Students in the exemption programme can be exempted from taking a computer course, but are required to take part in the examination. Some teachers have carried out a follow-up investigation on these students and found that these students have almost realised the autonomous learning pattern under the guidance of teachers. A student's autonomous learning process is designed scientifically. A student's part is composed of autonomous learning, submitting case designs, questions and discussions, a testing phase and a comprehensive test. The teacher's part is composed of establishing a teaching resource library, guidance, correcting homework, providing feedback, a testing phase and follow-up supervision.

First, the tutor will divide the teaching content into six modules according to the teaching requirements of Fundamentals of Computers, and design basic case examples and comprehensive cases by combining the modules of each chapter. The tutor will guide the students to learn step-by-step and focus on the cultivation of student's operating ability and self-study ability.

Second, with a network teaching integration platform, students will be provided with *Fundamentals of Computers Exemption* network course resource, which will be the resource for the autonomous learning after class. Further, the

tutor will lead students to take a selective course related to computer applications according to their interests or major, such as graphic design, Web page design, multi-media courseware making and access database technology or lead them to participate in computer-related associations and other competitions.

TEACHING MODE INTEGRATED WITH CLASSROOM TEACHING, EXPERIMENT TEACHING, NETWORK TEACHING FOR STUDENTS IN THE COMPULSORY PROGRAMME

This teaching mode aims to understand a student's mastery of the teaching content from the analysis of a student's examination and a questionnaire survey. In the meantime, the teacher will also carry out teaching activity according to the student's level. Group teaching and computer guiding will be integrated into one teaching mode, which is the combination of teaching theory and practice. Each student has one computer; when the teacher explains to the students, they operate the computer and do exercises, with the teacher distributing teaching documents, handing in homework, Q&A with the help of LAN, and ensuring the teaching results of the course.

Monitoring a student's status of hearing a class and understanding a student's mastery of knowledge, improving a student's efficiency in classroom learning, and realising LAN teaching and multi-media teaching in the computer laboratory are enhanced by making use of multi-media teaching software.

The teacher teaches students by readjusting various resources on-line and making full use of network resources after class. The *network teaching platform* has provided students with an ideal digital learning environment. With the case learning mode and cooperation learning mode, it helps students to cultivate innovation ability and promotes their individual development, providing a sound environment for a student's automatic learning and project development. Teachers will also strive to create sound conditions, launch diversified extracurricular activities for students, carry out computer skills competitions, organise computer-related associations, and improve students' interest and enthusiasm in learning.

ADOPTION OF *STRATIFIED TEACHING WITH CASES*

Stratified teaching with cases is adopted for students of both the exempt and compulsory programmes. Professional teaching cases are divided into the *basic type*, *after-class type*, *improvement type* and *comprehensive type*; and students of the exempt programme are required to complete the cases according to their preference, whereas students of the compulsory programme are required to select *compulsory case* and *selective case* according to the student's foundation.

Students with a sound foundation must be guaranteed that they have something to do in the class, while students with a poor foundation must be assured that they can follow the learning schedule. Automatic design should be added in both the *improvement type* and the *comprehensive type* to set additional points for students and to improve a student's learning initiative. In the meantime, cases or knowledge of important chapters will be recorded as *micro-courses*, so that students can review them after class.

THE INTRODUCTION OF THE COMPUTER OFFICE AUTOMATION EXAMINATION AS PART OF THE COURSE ASSESSMENT

The introduction of the Jilin Province college student computer office automation examination is regarded as an integral part of course assessment. For the assessment of this course in the past, classroom performance accounted for 30%, and the final examination accounted for 70%.

The Jilin Province college student computer office automation examination (Jilin Region) was introduced after the introduction of the educational reform, in which the original way of assessment accounts for 50% and the Level-II examination also accounts for 50%.

Students will be regarded as fully *qualified* in the examination when their academic performance of the two examinations is greater than or equal to 60 points. Students' learning results can be objectively checked from the Jilin Province college student computer office automation examination or can be compared with the other universities of Jilin Province. From the overall condition of students who participated in Level-II examination over the past two sessions, sound achievements are yielded.

COMPARATIVE ANALYSIS OF THE LEVEL-II EXAMINATION PERFORMANCE AND THE FINAL EXAMINATION

In accordance with the *reform solution for Fundamentals of Computers*, the author has followed the learning process of students of Grade 2014 in terms of the Fundamentals of Computers (for details please see Table 1), and conducted a comparative analysis of the students' learning results, providing the basis for the teaching reform of Fundamentals of Computers. Data of the *college entrance graded testing performance*, *level-II examination performance* and *final examination performance* are presented in Table 1, with the analysis of the result of academic performance shown below in Table 1.

Table 1: Comparative analysis of the result of academic performance of the computer operating test of 2014 session.

Examination type Statistics item	Entrance examination	Level-II examination	Final examination
Number of person	2,320 persons	2,309 persons	2,310 persons
Average point	24.5	84.6	76.9
Highest point	72.9	99	99.2
Lowest point	2.1	19.3	13.5
Excellence rate	0%	57.6%	31.6%
Pass rate	0.73%	99.6%	91.6%
90-100 points	0	765 persons	275 persons
80-90 points		903 persons	771 persons
70-80 points	2 persons	428 persons	659 persons
60-70 points	15 persons	156 persons	411 persons
50-60 points	76 persons	10 persons	134 persons
40-50 points	192 persons		60 persons
30-40 points	367 persons		
Below 30 points	1,668 persons		
0 (Absent)		47 persons	

As shown in the analytical statement and Tables 2-4, which report on academic performance, one can see that the computer knowledge and operating ability that the students master before university are not as good as expected. To guarantee a satisfactory teaching result, only a few students can be exempted from taking the computer courses. Most of the students obtained less than 30 points in the graded examination.

A sound performance was made in level-II examination with the average points of 84.6, with an excellent rate of 57.6% and an overall pass rate of almost 100%. Due to the fact that the difficulty was greater in the final examination, the students only obtained the average score of 76.9, the excellent rate of 31.6%, the pass rate of 91.6%.

In terms of the comparison of single item points, it can be found that an excellent performance in teaching was made, with an average score rising from 24.5 at the beginning to 84.6 in the level-II examination, and to 76.9 in the final examination; the highest point increased from 72.9 at the beginning to 99 in the level-II examination and to 99.2 in the final examination. A great improvement was also made in student's operational ability, operational skills and software application skills, providing a solid foundation for the student's learning, especially, specialised courses in the final.

Table 2: Comparative analysis of *scores section* of grade 2014 computer operating level test.

Data item	Entrance examination	Level-II examination	Final examination
90-100 points	0	765	275
80-90 points	0	903	771
70-80 points	2	428	659
60-70 points	15	156	411
Below 60 points	2303	10	194

Table 3: Comparative analysis of *single item scores* of grade 2014 computer operating level test.

Data item	Entrance examination	Level-II examination	Final examination
Average Point	24.5	84.6	76.9
Highest Point	72.9	99	99.2
Lowest Point	2.1	19.3	13.5

Table 4: Comparative analysis of the *pass rate* of grade 2014 computer operating level test.

Data item	Entrance examination	Level-II examination	Final examination
Excellence rate	0%	57.60%	31.60%
Pass rate	0.73%	99.60%	91.60%

CONCLUSIONS

After two years of experimenting with this system, the system that is divided into selective and compulsory courses, it has been found that stratified teaching with cases is an effective teaching method. It has fully embodied the modern teaching philosophy that may vary from person to person, and that they should be taught accordingly. Stratified teaching also focuses on the demand of specialty, and should be combined with application-oriented and student-based

individual development. As shown in the analysis of academic performance, the course teaching effect has been good and students have achieved a high level in computer operation.

Furthermore, the conduct of this research and the experimental results may provide a useful reference for the curriculum reform in similar universities and colleges.

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