ABSTRACT: It has become an important subject to reform Computer Application Technology (CAT) major in higher vocational colleges against the backdrop of fierce competition. Firstly, this paper analyzes the prevailing problems in this major and their causes. Secondly, this paper proposes that reform in CAT major can only be realized based on the tripartite linkage of industry, enterprise and college. Thirdly, this paper further introduces the channel for major orientation, course system development and teaching staff building with the mechanism of tripartite linkage.

Categories and Subject Descriptors:
K.3.1 Computer Uses in Education J.6 COMPUTER-AIDED ENGINEERING

General Terms: Computer Application Technology, Course Development

Keywords: Higher Vocational Education, Computer Application Technology Major, Course system Development, Tripartite Linkage

Received: 16 November 2011, Revised 10 January 2012, Accepted 15 January 2012

1. Introduction

In the recent decade that has seen the gradual promotion of nationwide information construction and prosperous development of higher vocational education in China, the CAT major in higher vocational colleges has provided a large number of advanced talents in CAT for the production, service and management section in many industries in China. However, as many higher vocational colleges have opened up the same or relevant majors, graduates from these majors are faced with great pressure in finding jobs. Moreover, with the promotion of mass higher education, the orientation of talent cultivation for most undergraduates has gradually shifted to being application-oriented, rather than technology-oriented. Besides, many local governments strengthen the support for secondary vocational colleges, which leads to a remarkable improvement in teaching quality of computer-related majors in these secondary vocational colleges. Sandwiched between undergraduate education and secondary vocational education in terms of CAT major, higher vocational colleges shall pinpoint the orientation and pursue specialty given the current tough market [1]. This is a key subject nowadays.

2. Existing Problems and Causes

Surveys show that CAT majors in higher vocational colleges generally have two problems as follows.

1) Part of students show little interest in major courses; some even grow weary of learning, thus leading to poor initiatives in study and bad academic results.

2) Knowledge and skills graduates possess differ greatly from what potential employees want and so employment is bad.

There are many causes for these two situations: students in higher vocational colleges generally are of poor academic performance and possess little competence in study and exploration; major orientation aims too high and courses are too difficult; the way students are taught resembles that in undergraduate and vocational colleges, without the identity of higher vocational colleges; major-related courses aren’t geared towards market requirements.

After classifying the above causes, it can be found that the crux has mainly two aspects as follows.

1) In determining major orientation and major-related
courses, students as the subject are often neglected and study performance isn’t analyzed based on students.

2) The determination of major orientation doesn’t take into account the locality of higher vocational education, namely not geared towards local market demands and lacking interaction with local industries & enterprises in developing the major [2].

3. Major Reform Based on Tripartite Linkage

Higher vocational education must emphasize and enhance locality [3]. What higher vocational education strives to cultivate are application-oriented talents in the forefront of production, who are directly and closely related to local industries and enterprises. Moreover, with large difference in students and in order to achieve better teaching effect, higher vocational education should focus on students. And reform in CAT majors in higher vocational colleges must jointly motivate the tripartite linkage of industry, enterprise and college.

3.1 Major Orientation Based on Tripartite Linkage

Major orientation is central to major development. Only with accurate orientation in cultivating professional talents can there be employees with good performance and favor of companies. Before major orientation, first analyze the market by interacting with local industries and enterprises, and the focus should be on post and competence requirements of jobs related to CAT. Next, visit & interview students, and analyze their major ability and cognitive patterns. Last but not least, a Major Guidance Committee should be established with technology staff in enterprises and key teachers in the college, which shall, based on college condition and market demand, determine the core post, prospective post and talent requirement for students of CAT major in higher vocational colleges. In the following paragraphs, we will make an introduction with the example of a state demonstrative college of higher vocational education – CAT major in Wenzhou Vocational & Technical College.

CAT major in Wenzhou Vocational & Technical College is a key major in Zhejiang Province. First, given information associations, software associations and cartoon associations in IT industry in Wenzhou City, the college surveys the market demand of CAT major in local enterprises, and the result is shown in Figure 1. As this college already has Information Management Major, the CAT major focuses on network maintenance, multimedia technology and software programming as cultivation content. Moreover, the structure of technology staff in IT enterprises in Wenzhou City is like an olive tree – there’s only a little demand for high and low-level talents but tremendous demand for middle-level talents. Besides, most enterprises demand that students possess professional specialty and work upon employment or with a short period of training.

Next, an analysis is performed of students. The students in CAT major in Wenzhou Vocational & Technical College can fall into two types which are 1) senior high college graduates, who are good at logical thinking and have good study habits but poor practical skills, and 2) secondary vocational college graduates, who are weak in logical thinking but strong in practical skills.

Then, frontline technicians and key teachers form a Major Guidance Committee that carries out discussions on major orientation. The Committee unanimously agrees that for such students, comprehensive cultivation of talents in network maintenance, multimedia technology and software programming is obviously too high an aim. So, the major focuses on cultivating core talents like network administrator, programmer and multimedia technician, thus aiming to foster students’ core competence in working in a certain core post. Based on this, students can study independently, receive on-job training or accumulate work experience to be qualified for positions like network engineer, program designer and animation designer (namely professional posts).

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In accordance with major orientation, the cultivation target is to be geared towards information industry and IT industry, to cooperate with relevant enterprises in Wenzhou City, to cultivate talents like network administrator, multimedia technician and programmer, to be equipped with ability in operating and maintaining software and hardware, to have professional specialty in computer software, computer network and multimedia, and to cultivate quality application-oriented talents with good occupational morality.

3.2 Course System Development Based on Tripartite Linkage

Given that cultivation targets of major are determined, next step is to design major courses. In doing so, it's still necessary to consider the three factors of industry, enterprise and student. First, graduates of CAT major should meet the requirements of IT industry, namely being equipped with fundamental knowledge and skills of CAT like computer installation and maintenance and use of common office soft wares. These knowledge and competence can be trained by opening up major-related basic courses. Second, graduates of this major in higher vocational colleges should possess professional skills and ability required by enterprises. This can be realized by opening up professional major courses. Third, these graduates should have core competence required for specific posts in enterprises. The major can have training courses for posts to strengthen the core competence. The following Figure 2 shows what has been said. Moreover, in course development, it's crucial to take into account students' major foundation and cognitive patterns, and to engage students in courses that most interest them. This will create an atmosphere where students enjoy and take delight in study.

![Figure 2. Developing Major Course System](image)

In Wenzhou Vocational & Technical College, CAT major comprehensively considers the 3 factors of industry, enterprise and student and sets up a “1+3” course system. “1” refers to one platform of basic major courses, and “3” refers to three distinctive professional courses – network, multimedia and software. The major in this college requires 3 years’ learning (6 semesters in all), and the arrangement is as follows.

In the first college year, there will be general courses and basic major courses that cultivate students’ basic quality, basic knowledge and competence, aiming to be geared towards industrial requirements and teaching the basic knowledge and skill of CAT major. Basic major courses include the introductory courses of three professional directions. With this, students will have some basic knowledge of future directions while studying these courses. Students will also be clear about their interest and lay solid foundation for future professional study. At the end of the first college year, students need to voluntarily choose a direction for studying professional courses at the second stage with teachers’ guidance.

In the second college year, students will be regrouped into different classes based on their choice of profession direction. Lessons will be given accordingly. Students with a direction only need to study their professional courses. This will develop their interest and professional specialty.

In the third college year, talent cultivation target emphasizes core practical competence required in a post that meets the market demands seamlessly. In the 5th semester, students will have job training sessions. There will be 4 integrated projects for each professional direction in this semester, and each project is to be completed within 4 weeks. These projects all truly exist in the enterprise or are jointly developed by technicians and teachers. With students as subjects, teachers will simulate development environment in enterprises and divide students into development groups. Group leaders shall be responsible while teachers guide and supervise. In the 6th semester, students will intern at the enterprise for post practice and finish graduation projects related to the enterprise.

4. Construct the Training System Based on Tripartite Linkage

At the present time, most courses in computer majors of higher vocational education are application courses including software design, animation design and production, plane image processing, and webpage design and production. These difficulties shall be solved in the computer application courses in vocational education including how to cooperate with the local industries & enterprises in developing and construct the training system, how to arrange each practical teaching link reasonably, and how to perform feasible appraisal on practical skills of students.

4.1 Three Ways to Develop Students with Practical Capacity

Compared with other majors and other courses, the computer application courses in higher vocational colleges shall further extrude the practical trait of the courses. These courses shall develop students with stronger practical capacity. The development of this practical capacity can be completed through three ways as follows.

1) Develop students with the practical capacity through the way of training of basic skills. Realizing the integration
of Practical teaching room with classroom, the teachers can give lessons through demonstration, and students can learn from the practice.

2) Develop students with the practical capacity through the way of training of comprehensive skill. Realizing the integration of Practical teaching and production, the students can attend the production and practical teaching in the training bases both inside and outside the school to develop their position capacity.

3) Develop students with the practical capacity through the way of training of creative conscious. Realizing the integration of graduation project and development service, the students can develop the position capacity by selecting real projects from companies as the title for the comprehensive practice of graduation project.

4.2 A Training System of Four Stages
The computer application courses in higher vocational colleges can construct a training system of four stages based on the tripartite linkage of industry, enterprise and college. The skills of students increase along with the stages. The four stages are as follows.

1) Core skill practice. It is arranged after the common case study or chapter teaching to develop the core single skill of these courses.

2) Simulated project practice. The simulated project practice will be introduced when single core skill of students has achieved certain level. As a result, students can apply the skill learned from the previous practice stages comprehensively. Then, students will perform the single core skill practice for the next stage.

3) Order project practice. The students will enter the students' studio when they have certain comprehensive skills. The students' studio can undertake certain order projects and organize students to perform the order project practice. The core skill practice, simulated project practice and order project practice is performed in cycle.

4) Position practice. With certain accumulation, students can perform position practice in the practice bases both inside and outside the school to experience real work environment and work task.

4.3 Arrangement of Practical Teaching Links
In the first stage of the training system, students will attend the core skill practice when they finish a case study (or a chapter). The students at that time will complete training fake questions (namely "fake questions", which are not real work tasks) covering core skills designed elaborately by teachers in class of the school (namely "fake practice", which is performed not in real work environment). When students master certain core skills, they begin to perform simulated project practice and complete classic work task in school class, which is fake practice for real questions. When students have mastered certain skills, based on the students' studio, the order practice is performed in the work situation education by organizing students to finish the order tasks from institutions and companies in the market gradually according to actual company operating system. As a result, students can contact real production task. Finally, based on the practice bases both inside and outside the school, students are organized to perform position practice to experience real development work in companies and enterprises. Both in the order project practice and the position practice, students can complete real tasks in real work environment, as shown in figure 3.

Computer application courses in higher vocational colleges are suggested to apply training system of four steps as described above to realize a teaching mode of working and learning alternation (shown in figure 4), which includes a number sectors such as learning, work (simulated project practice), learning, work (order project practice), learning, work (position practice). As a result, students can learn from the practice and perform practice from learning. The professional work capacity and professional comprehensive quality can be developed. During the order project practice and position practice, based on the students' pioneering studio set up by students and practice bases both inside and outside the school, the real work environment can be set up. With teaching mode integrating with production and study, students can exercise and promote their capacity to analyze problems and solve problems through the technical service when they undertake project social technical service. In addition, the course goal of serving region can be fulfilled.
4.4 Evaluation of Practical Skills
The evaluation of practical skills has not only tested the professional comprehensive knowledge and skills of the students, but also tested whether the students have the professional capacity and quality required by companies including teamwork skill, creative skill, and word expression skill, etc. The plan for the evaluation of practical skills is as follows.

1) Personal test. Each student develops a simulation project with certain comprehensive difficulty independently in specified time (such as two days) according to the project effect given by teachers. The personal performance of each student will be assessed according to certain standard for evaluation.

2) Team test. Students are divided to different groups. The amount of students is determined according to scale of orders. Every group completes the design order of comprehensive development given by teachers through cooperation in specified time (such as 1 week). The works are assessed according to the requirement of design order, works originality and team cooperation status.

3) Determination of final performance. The final score of the practical skill test is subject to the lower performance of the personal performance and the team performance, which has reflected that personal individual work capacity and teamwork capacity is a whole, and not one of them can be dispensed with.

5. Building Teaching Staff Based on Tripartite Linkage
Building the teaching staff is the solid foundation for smooth progress of major reform, and the connotation of higher vocational education expects more of teachers. First, since this education is in a higher range, it falls into the type of higher education. This property distinguishes itself from secondary vocational colleges that belong to basic education. Therefore, higher vocational education doesn’t aim to cultivate skill-oriented talents with a good mastery of job skills, but specialized technology-oriented talents that are capable of strategy and design. This requires college teachers to be qualified with the competence of production, operation, organization, planning and product R&D in a specialized core post. Second, the vocationality of higher vocational education indicates that this education belongs to vocational education, thus necessitating occupational competence as core target. So, practice-centered education must be given prominence to, since practice is what significantly distinguishes higher vocational education from undergraduate education. This requires teachers that graduate from universities not to copy the teaching mode and content in their undergraduate universities, but combines practice with education and emphasizes productive practice. It means that teachers should be equipped with the ability to work and the skills to train productively. Third, the locality of higher vocational education means that this education must meet the demands of local markets for highly-skilled talents, which requires teachers to be qualified for the local market in terms of knowledge and skills.

The feature of higher vocational education requires teachers to be dually qualified in working and productive training, and these two abilities are obtained from industry and enterprise. So, the teaching team must to be built jointly by industry, enterprise and college with mutual interaction. During this process, a share system should be established based on complementary advantages [4]. In this way, the cooperation between college and enterprise will last long and go smoothly.

Building this team of teaching staff can employ the mode of "Inviting in and Going out" which includes the following aspects. 1) Invite technicians at IT enterprise forefront to be part-time lecturers, especially for those training courses that require strong comprehensive job ability. 2) Invite IT general manager or technical director to give lectures to
inform students of new knowledge and market tendency in IT industry and enterprises [5]. 3) Invite enterprises to move partially into college and set up on-campus training base, for enabling communication, study and cooperation with technicians and key teachers and for introducing real work projects for teaching that will develop students’ actual skill. 4) Choose major teachers for full-time or part-time technical training held by education departments and famous enterprises, thus inseminating teachers with new demands of markets for CAT technology. 5) Cooperate with enterprises to build out-campus training bases, headed jointly by teachers and technicians, which enable teachers and technicians to study and improve together. 6) Give full play to teachers’ professional ability and teaching specialty, designate key teachers for technical service in enterprises and for training company employees. 7) Choose good teachers to be members of industrial associations and assessors in company recruitment.

6. Summary

First, the subject of higher vocational education is students, so the analysis of study performance should be based on students in the reform of CAT major in higher vocational colleges. Major orientation and course design should fit the cognitive patterns of the students. Second, the locality of higher vocational education dictates that reform of CAT major should fit in with the local market demands. Third, the connotation of higher vocational education necessitates the interaction and cooperation with the industry and enterprise while building staff of CAT major. Therefore, only by cooperating with industries and enterprises can higher vocational colleges work out the orientation and course development of the major in their colleges. Only in this way can these colleges effectively build a staff team dually qualified in teaching and productive working.

7. Acknowledgment

This paper is sponsored by Planning Project of Education Science in Zhejiang Province in 2007 – Preliminary Exploration into Reform in CAT Major in Higher vocational colleges with Market Orientation and Based on Human-Centered Education (No. SC152).

References


