Optimization and improvement of software and theory comprehensive training

Wenjun Yu¹, Yu Huang¹, Bin Hu and Junxiang Gao*

¹The first two authors contributed equally to this paper
College of informatics, Huazhong Agricultural University, Wuhan, Hubei, China

*Corresponding author e-mail: gao200@mail.hzau.edu.cn

Abstract. The rapid development of information science and the transformation of modern teaching concepts have made the teaching work more inclined to the cultivation of students' practical ability. Comprehensive training is a teaching activity for the better application of students' computer theory knowledge. The research and practice of practical teaching system, practical teaching content and practical teaching methods are particularly important in the teaching work of colleges and universities. Based on this, we have built and improved the core layer of the practical teaching system, namely the comprehensive training of software and theory.

1. Introduction

With the rapid development of information science and technology, modern computer technology has made the demand for computer personnel in today's enterprises constantly improved, and the transformation of modern teaching concepts has made teaching work more inclined to the cultivation of students' practical ability [1-4]. Comprehensive training is a teaching activity for better application of students' computer theory knowledge. Enterprises need to employ computer personnel with rich theoretical knowledge base and strong practical ability to carry out related work of enterprises and strengthen comprehensive training has become a college student. The key to the development of computer theory comprehensive ability. Therefore, research and practice on the practical teaching system, practical teaching content and practical teaching methods around the requirements of first-class undergraduate education for practical teaching are particularly important in the teaching work of colleges and universities [5-7].

Many universities at home and abroad have carried out various forms of comprehensive practical teaching projects. The Department of Computer Science of the school has also carried out four years of comprehensive training in software and theory. Although we have made many achievements in the construction of practical teaching system, there are still some problems: (1) the practice teaching system is incomplete and does not form a clear practical teaching system structure; (2) the practice teaching content is not standardized, Lack of core knowledge point norms, no training project database, some training topics do not effectively combine the core knowledge points of the course, so that professional students cannot establish a clear computer architecture layering ideas; (3) The implementation plan for practice teaching is not perfect, including topic selection, pre-training tasks, specific training methods and defense methods.. These directly affect the quality of comprehensive training [8,9].
In this paper we describe how to build a core knowledge point specification, how to design comprehensive training plan, and how to build a sound training program [10-13]. In general, we realize an optimization comprehensive training platform.

2. Methods

2.1. Key issues to be resolved

(1) Establishing core knowledge point norms is the key to constructing 2+1 practical teaching system. These knowledge points mainly come from basic courses and some professional courses. How to organize, extract and associate these knowledge points is the key issue to be solved in this topic.

(2) The design and construction of the training topic database is the key to standardizing the content of practical teaching. It mainly relies on the core knowledge points compiled in the previous step and designs the training projects that cover all the knowledge points as much as possible, so as to expand the profession. A hierarchical view of the student computer architecture.

(3) Designing the software design process specification that conforms to the characteristics of this training is to further improve the practical teaching plan. The characteristics of software and theory comprehensive training mainly include incomplete professional course system knowledge (for sophomore students), limited training time, limited training mode and multi-person collaboration.

2.2. Research content and objects

(1) Establish a 2+1 practical teaching system, that is, adopt a combination of professional basic skills training (software and theoretical comprehensive training), professional comprehensive ability training (computer application comprehensive training), and enterprise base internship. That is, the "2+1" talent training model. The core layer of the system: software and theory comprehensive training, integration of computer science basic courses and professional courses of core knowledge points (including "C language programming", "computer composition principle", "algorithm design", "computer network" and "Java language programming", etc.), to achieve the core knowledge point specification.

(2) Build a training project database in accordance with the core knowledge point specification, and design 8-10 software and theoretical comprehensive training topics into the library for each academic year. All training topics effectively combine the core knowledge points. Further standardize the content of practical teaching.

(3) In accordance with GB8567-88, we formulate a complete training plan and detailed training process to guide students to complete the training courses within the prescribed hours, which can improve students' comprehensive layered software design capabilities [14,15].

Comprehensive skills training is an indispensable part of the "2 + 1" talent training model. The final result of this skills training directly affects the effect of the "2 + 1" talent training model reform. According to the cooperation norms of schools and enterprises, and in accordance with the established principles of comprehensive training, the training forms are divided into three categories:

The first category is software and theoretical training. We design the training plan according to the existing laboratory conditions and resources. The plan is mainly arranged at the end of the fourth semester. Under the guidance of teachers, computer majors will complete various software design projects and pass the defense.

The second category is to examine the students' medium-sized application design ability. The training is arranged at the end of the sixth semester. We develop medium-scale application design projects, which require students to have a high comprehensive design ability. At the end of the training, the teacher will still evaluate the students based on their performance.

The third category is internship training, arranged at the end of the sixth semester. After all the basic comprehensive training is completed, we will organize students to go to the company to participate in internships in batches. The internship program is jointly formulated by the college and the company. After the internship, the company will feedback the students' comprehensive performance to the school, and the students' final internship results will be given by the college and the company (see Figure 1):
Figure 1. The architecture of the Comprehensive Training.

Among them, the construction of standardized software and theoretical comprehensive training is the key to realize the "2+1" practical teaching system, and the standardization of the core knowledge points of the curriculum, the standardization of practical teaching content and the improvement of the practical teaching plan are to realize the integration of software and theory. The core part of the training.

After two years of study, students in the computer science department have a certain foundation for the theory and operation skills of the design software and can complete the simple tasks assigned by the teacher. But the knowledge is single, and I don't know how to make full use of and link various knowledge points to form a unified line and face. Therefore, when faced with actual coding, the theoretical and operational knowledge learned was not realized. For example, if students are required to complete chat software design, they will not be able to use a variety of professional design tools, combined with their own professional theory, to complete this creative work. Therefore, in the comprehensive training course, students should be guided to learn how to use a variety of software, emphasizing the purpose of practical application. Taking software and theoretical comprehensive training courses as an example, we can refer to but not completely limit the following links (software design national standard GB8567-88), and the following links need to be further studied and adjusted in practice [16-20].

(1) In the demand analysis session, the students complete the pre-document reading, demand analysis and project division (according to the national standard for software design) according to the training program given by the teacher, starting at least 2 months before the next link.

(2) The project training session, in the specified time (7 days, 56 class hours), complete the project in a fixed laboratory, and complete the system and various system documentation according to the national standards of software design.

(3) In the project defense session, the instructor will give comprehensive results based on the student's training situation, combined with the completion of the system and related documents.

2.3. The main method adopted

(1) The key of this project is to extract the basic knowledge points of computer basic courses and some professional courses to form norms, and initially rely on the principle of combining the teachers of this major with the opinions of experts outside the school. First of all, we divide the group teachers into basic and professional groups, extract and summarize the knowledge points of each course, and then invite experts to hold small meetings within the school, or participate in national computer practice teaching meetings, and finally complete the specification of core knowledge points.

(2) In order to further improve the practical teaching content, the primary task is to design the training topic. The design of the training project must be strictly in accordance with the core knowledge point specification, and the design of the training project should be completed with reference to the system design pattern specification.

(3) We will build a software design process specification with reference to the national standards of software design and the characteristics of the school's comprehensive training. The specific adjustment
will be made in the practice teaching link, provided that the core knowledge point specification and the system design pattern specification are not affected.

3. Result
After completing this project, we have realized the core layer of the practical teaching system, namely the comprehensive training of software and theory: (1) build a core knowledge point specification. Many computer-based and professional subjects focus on theoretical, intellectual, and systematic, and do not form links to complete knowledge points, thus making it impossible for related students to construct a complete computer architecture vision. (2) Design a series of comprehensive training plans. Teachers design questions according to the comprehensive training norms and enter them into the question bank. These questions can greatly improve the application system design ability of computer students. (3) Build a sound training program. In traditional practical courses, students mainly complete confirmatory experiments, which will lead to their lack of innovative ability. Therefore, the development of a standardized training plan is currently the most urgent task.

4. Discussion
The project is characterized by the construction of a relatively complete core layer of 2+1 practical teaching architecture: software and theoretical comprehensive training. The innovations are as follows:
(1) For the first time, the relevant knowledge points of the basic courses and professional courses of computer science and technology are extracted, and the core knowledge point specification document is formed. This document has important reference value and guidance for constructing 2+1 practical teaching system structure.
(2) The software and theory comprehensive training project database is constructed, which can provide diverse and reasonable choices for students participating in the training.
(3) Combining the characteristics of the comprehensive training of the major, the software and theory comprehensive training process plan guidance norms are formed, and the specification has certain reference value for other trainings.
The training program formed after the completion of the project, the knowledge point specification, etc. can be promoted in relevant colleges and universities, and the training project database can be shared, so it has considerable application value.

5. Acknowledgments
This work is supported by “Teaching reform and research project in colleges and universities of Hubei province” under Grant No. 2016172, Grant No. 2017192 and the State Scholarship Fund (No. 201706765027).

References
[1] Moeller K, Fischer U, Nuerk H C, et al. Computers in mathematics education—Training the mental number line.[J]. Computers in Human Behavior, 2015, 48(C):597-607.
[2] Cooper D, Dougherty D. Enhancing process control education with the Control Station training simulator[J]. Computer Applications in Engineering Education, 2015, 7(4):203-212.
[3] Mullins C R, Pairis-Garcia M D, Campler M R, et al. The Development of an Interactive Computer-Based Training Program for Timely and Humane On-Farm Pig Euthanasia[J]. Journal of Veterinary Medical Education, 2018:1-8.
[4] Yu H, He X, Yan X, et al. Construction and evaluation of PHP-based management and training system for electrical power laboratory[J]. Computer Applications in Engineering Education, 2016, 24(3):371-381.
[5] Fang X D, Luo S, Lee N J, et al. Virtual machining lab for knowledge learning and skills training[J]. Computer Applications in Engineering Education, 2015, 6(2):89-97.
[6] Attwood T K, Atwood T K, Bongcamrudloff E, et al. GOBLET: the Global Organisation for Bioinformatics Learning, Education and Training.[J]. Plos Computational Biology, 2015, 11(4):e1004143.
[7] White S W, Richey J A, Gracanin D, et al. Psychosocial and Computer-Assisted Intervention for College Students with Autism Spectrum Disorder: Preliminary Support for Feasibility[J]. Education & Training in Autism & Developmental Disabilities, 2016, 51(3):307.
[8] Sullivan N. An integrative review: instructional strategies to improve nurses' retention of cardiopulmonary resuscitation priorities.[J]. Int J Nurs Scholarsh, 2015, 12(1):37-43.
[9] Rausch A, Seifried J, Wuttke É, et al. Reliability and validity of a computer-based assessment of cognitive and non-cognitive facets of problem-solving competence in the business domain[J]. Empirical Research in Vocational Education & Training, 2016, 8(1):9.
[10] Rowther A A, Dykzeul B, Billimek J, et al. Computer-Assisted Diabetes Risk Assessment and Education (CADRAE) for Medically Vulnerable Populations in the Middle East: a Novel and Practical Method for Prevention[J]. Journal of Global Health Perspectives, 2015, 1.
[11] Urbikain G, Norberto L D L L. Training and learning of specialized engineers by means of a new advanced software[J]. Computer Applications in Engineering Education, 2015, 24(2):241-254.
[12] Stefanovic M, Tadic D, Nestic S, et al. An assessment of distance learning laboratory objectives for control engineering education[J]. Computer Applications in Engineering Education, 2015, 23(2):191-202.
[13] Aly M, Willems G, Carels C, et al. Instructional multimedia programs for self-directed learning in undergraduate and postgraduate training in orthodontics.[J]. European Journal of Dental Education, 2015, 19(1):20-26.
[14] Faucher, Chantal|Cassidy, Wanda|Jackson, Margaret. From the Sandbox to the Inbox: Comparing the Acts, Impacts, and Solutions of Bullying in K-12, Higher Education, and the Workplace.[J]. Journal of Education & Training Studies, 2015, 3(6):111-125.
[15] Ari M. A multipurpose test and measurement module with touchscreen and computer interface for engineering and technical education[J]. Computer Applications in Engineering Education, 2016, 24(6):905-913.
[16] Taha J, Czaja S J, Sharit J. Technology Training for Older Job Seeking Adults: the Efficacy of a Program Offered through a University-Community Collaboration[J]. Educational Gerontology, 2016, 42(4):276-287.
[17] Ungerleider R M, Verghese G R, Ririe D G, et al. Selection, Training and Mentoring of Cardiac Surgeons[M]// Pediatric and Congenital Cardiac Care. 2015.
[18] Liu C H, Huang Y M. An empirical investigation of computer simulation technology acceptance to explore the factors that affect user intention[J]. Universal Access in the Information Society, 2015, 14(3):449-457.
[19] Kuchewar V V, Tankhiwale S. Evaluation of efficacy of computer based simulation method in the clinical teaching of Final BAMS students[J]. 2015.
[20] Yalcın N, Altun Y, Kose U. Educational material development model for teaching computer network and system management[J]. Computer Applications in Engineering Education, 2015, 23(4):621-629.