Reform and Practice of Training Practice and Innovation Ability in Information Discipline Experiment Teaching

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Abstract. The professions of information discipline have the characters such as strong innovation, technology updating quickly, combining with applications tightly etc., consequently the experiment practice teaching plays an important role in cultivating information technology innovative talents. During the process of innovation and exploration of experiment teaching, School of Information Science and Technology in Qingdao University of Science and Technology accumulates valuable practical experience in improving students' practice ability, the adaption ability to the future workplace. Taking it as an example, the paper describes four feasible measures in the exploration. With the proposed education strategy, the quality of experimental teaching is improved, and students' innovation spirit and ability are further aroused, and good teaching results are also achieved.

Introduction

The rapid development of the country urgently needs lots of information technology talents with innovative spirit and ability [1]. To cultivate innovative talents of information discipline, the subject characteristics should be figured out, thereupon the corresponding education concepts should be established [2]. The professions of information discipline have the characters such as strong innovation, technology updating quickly, combining with applications tightly etc., consequently the innovation is required for new technologies development, as well as the ability of knowledge application in diverse fields [3,5]. Especially with the change of social demand for information technology talents, the practice teaching plays a more and more important role in the training of creative talents.

There are six undergraduate majors in the School of Information Science and Technology, Information Engineering, Computer Science and Technology, Communication Engineering, Software Engineering and Internet of Things Engineering respectively.

In recent years, the college has carried on a series of exploration and reform in the practice teaching method. The education idea is focused on independent thinking, the innovation spirit is formed in the development of personality, and the innovation ability is cultivated in practical education. Through a number of effective measures, remarkable effects are achieved in improving students' practice ability, cultivating their innovation spirit and ability. The measures mainly include four aspects. First, contents and methods of practice education are improved, the cultivation of students' practice ability and innovation ability is attached great importance. Second, the diversified and procedural evaluation system is established, which focus on the ability enhancement. Third, the experimental teaching platform is built and labs are opened hierarchically. Last, the students' innovation spirits are aroused through science and technology competitions and research projects.

Transforming the Practice Teaching Goal and Reform the Teaching Method

Emphasizing Cultivation of the Ability of Practice and Innovation

In the teaching procedure, the contents imparted to students are changed from only knowledge to knowledge combined with skills, ideas, methods and so on. Hence, the study interesting can be
stimulated, furthermore students' professional knowledge are broadened and the practical skills are trained deeply.

To cultivate the innovation consciousness of students, teachers strengthen the student-centered idea, reform contents and methods of practice education, especially pay attention to students' autonomous learning. To make students think positively, a heuristic method is adopted, in which students are required to present their plan, discuss unsolved problems by themselves. In addition, independent experiments, small project development and research homework are introduced to promote students learning autonomously.

Combing the research project with the experiments, it is helpful to cultivate students’ creativity and engineering practice ability.

**Expanding Experiment Contents, Combining Teaching with Science Research Projects**

In the process of experiment teaching, students are encouraged to expand the experiment content after finishing the given assignments. That’s to say, they can choose, design topics and try to debug it by students themselves completely. Special guidance will give to some talented students with good training opportunities to complete small research projects. What’s more, students are afforded opportunities to show the development steps of the self-designed experiments. The measures mentioned above fully arouse the studying enthusiasm of students, stimulate them to learn independently, as well as the cultivation of the exploration and innovation spirit also greatly benefits from the environments.

On the other hand, teachers in the college adhere to combine the experimental practice teaching with the research projects. By leading a group of students with scientific and technology potential to take part in teachers’ research projects, it not only strengthens the foundations, but introduces the frontiers of scientific knowledge, not only stimulates learning interests and promotes heuristic learning, but unifies theoretical study and comprehensive practice.

**Reform the Practice Teaching Methods**

After designing the guiding steps for each experiment, the teacher provides an open opportunity for the students to present their research plan, discuss problems, and find out the optimum solution through the Interaction with teachers. It also creates a communication platform for all of the students and teachers and helps to improve the students’ presentation skills.

Moreover, the teachers of the same course regularly discuss and exchange the effective experimental teaching methods and experience together, and try to deal with the common problem in the teaching process.

**Establishing the Diversified and Procedural Evaluation System**

**Introduction of Multiple Estimators and Evaluation Methods**

Focusing on the ability enhancement, a diversified and procedural evaluation system is established. On one hand, the estimators not only include teachers, but also students in the same work-group. On the other hand, the evaluation result is achieved through the whole teaching process, e.g., class quiz, experimental results show, development of small project, research assignment or presentations etc. By means of the comprehensive ability evaluation method, the students' divergent thinking is cultivated, and also the students' personality development is encouraged. The education running throughout the education is of great benefit to students, it enhances their ability to analyze and solve problems in time. The teacher can also find out difference between individuals, and then guide students to find their specialty and interests.
Taking Independent Experiment as an Important Evaluation Part

In the professional experiment teaching of the information discipline, the student-centered practice teaching plan is considered and designed, subsequently the independent experiment is put forward. This kind of experiment takes an important role in cultivating the practice ability and innovation spirit of students. In the experiment reform, the teacher is in charge of selecting the project’s topic requiring more comprehensive design goals. It is up to the student to build models, propose algorithms and test the design scheme. Some high-level experiments are arranged to be accomplished by teams. So each one in the group takes charge of an assignment. This further develops students’ teamwork spirit. Finally, students will introduce innovative ideas, explore detailed implementation schemes, and present the results. It provides a good opportunity to improve presentation skills of students.

With the whole group working together, teamwork spirit and rigorous scientific research style are also improved during the experiments diversified and procedural evaluation system.

Building Experimental Teaching Platform and Opening Labs Hierarchically Through Multiform Experiments

Laboratory is very significant in terms of cultivating students’ innovation and practice ability [6]. In the experiment reform, breaking the specialty limitations, integrating and optimizing all the software and hardware resources, the college built an open and sharing experimental teaching platform. Based on the cloud storage and virtual reality laboratory technology, the platform along with the opening laboratories provides students with opportunities to develop the ability of discovering the obscure problems. Furthermore, the students can be equipped with certain practicable methods and skills to solve the detected problems, which can create a favorable environment for the students’ development of innovation.

The laboratories are opened by means of three forms of experiments. The first is scientific research experiment. This kind is mainly aimed at high grade undergraduates. The teachers having rich experience of scientific research project development are invited to release some subjects related to their research interests, the talented students will be qualified to study the relative knowledge in depth.

The second is technology-applied experiment. Concerning the teachers engaging in the projects supported by enterprises, they can refer to the detailed demand for application in the enterprise and provide some experiment topics. Based on this research requirement, the students with good engineering talent will be provided with the opportunities to participate in the project development.

The third is undergraduate self-made selective experiment. The lab regularly collects some student–made subjects, then entrusts teachers to select the student to conduct the research.

No matter what kind of experiment, under the guidance of instructors, the joining students will carry out their experiments through literature search, experimental design, intensive study and experimental practice etc. This enables students to experience a true scientific process.

Integration of Existing Experimental Resources Based on Cloud Computing and Virtual Reality Laboratory Technology

Besides opening labs to undergraduates hierarchically, the experiment teaching platform is allocated with rich software and hardware resources based on the cloud computing, cloud storage and virtual reality labs technology. The platform makes full use of internal and external resources and is opened to provide students with a fully open and free lab environment. Through the cloud computing opening platform, students can carry out experiments more conveniently and more flexibly. This can increase the resources utilization ratio.
Refining Undergraduate Innovation Education, Establishing Student Innovation Team

During the reformation, combined with science and technology competition, the students' innovative practice mechanism is improved. The science and technology innovation base is constructed. And the enterprise is also brought into the campus; this can acquaint the undergraduate with the current practical issues in the industry.

The college establishes incentive mechanism of students participating in teachers' research projects, builds the innovation laboratory and science and technology practice base. In this way, students are encouraged to participate in optional research projects in the laboratory under the guidance of competent teachers.

In the science and technology contest, the undergraduates will acquire the knowledge outside the classroom and further enhance their capacities of solving problems. To encourage students to carry out various competitions, the scientific and technology activity foundation is set up. In competitions, the undergraduates acquire the knowledge outside the classroom and further enhance their capacities of solving problems. Recently, the college and students have attached importance to all kinds of contests [7], such as the National Electronic Design contest, ACM program design contest, the national or provincial software design competition etc. During the contest, teachers are responsible for supervision and providing sufficient conditions or enough facility. More students participated in these contests and achieved good results.

Through establishment of innovative team and combination of production, study, research and contest, students' innovation and creation ability is motivated. What is more, students have more opportunities to combine theory with practice. As significantly stimulating active learning, student enthusiasm for studying is very high.

The undergraduates have improved their analysis and problem-solving skills through the diversified experiment teaching. And the considerable experience builds up their confidence and facilitates them well with the adaptability to future works.

Conclusions

The professions of information discipline have the characters such as strong innovation, technology updating quickly, combining with applications tightly etc. In the training of information technology innovative talents, the experimental and practical teaching is regarded as the breakthrough point.

During the exploration and reform process, we always persist in the student-centered principle and focuses on the needs of students’ development. The designed methods mentioned above integrate theory with practice, and can change the passive learning modes of students into the active ones and enhance their creativity in practice.

The independent learning enthusiasm of students is increased. The innovation capacity of students is improved, as well as students will have the sustainable development ability in the employment. At the same time, a series of learning achievements are obtained. Generally speaking, through long-term accumulation of practical experiences, these methods are proved to be effective.

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