A market-oriented innovative teaching model for courses in electronic information

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ABSTRACT: Cultivating market-oriented personnel specialised in electronic information is the basis for innovating and reforming the teaching mode of electronic information courses in China. Based on market demands, this article analyses existing problems in the teaching process of the electronic information specialty, proposes a new teaching model focused on the teacher, student, experiments and innovation (TSEI), and applies this model to two electronic information specialty classes. The teaching results indicate that students in the class that adopted the TSEI teaching model significantly improved their rates of completion, award winning and employment rate. This indicates that the TSEI teaching model can improve students' comprehensive ability and, therefore, it can become a viable reference for improvement of students in the education of electronic information specialty and perhaps the entire engineering field.

INTRODUCTION

Electronic information is a specialty that applies modern technology to control and process electronic information. It is mainly concerned with information acquisition and processing, electronic equipment, and also the design, development, application and integration of information systems. Electronic information engineering has addressed the needs of society in many ways, and has increasingly developed a closer correlation with economic development and human life.

The rapid development of electronic information science and technology industry raises more stringent requirements for electronic information talent in many aspects, such as work practice, teamwork and social adaptability [1]. Therefore, higher education should systematically consider the specific requirements and expectations that society has of educators i.e., that they be market-oriented and carry out more comprehensive and scientific teaching exploration and innovation in order to improve the teaching quality of the electronic information specialty.

ANALYSIS OF EXISTING PROBLEMS IN THE ELECTRONIC INFORMATION SPECIALTY - TEACHING PROCESS VERSUS MARKET DEMANDS

The Curriculum of the Electronic Information Specialty Lags Far Behind Market Demands

The curriculum of the electronic information specialty includes theoretical courses and practical courses. Theoretical courses can be divided into public basic courses and professional basic courses. Professional basic courses include circuit analysis, analogue electronic technology, digital electronic technology and digital signal processing. However, with the development of the electronics industry, especially the microelectronic industry, combined with the driving force of market demands, society has raised its expectations and demands of modern electronic technology, information technology, communication technology and other integrated specialties. The contents of professional theoretical courses cannot meet the requirements of market-oriented electronic information engineering, hence, there have been numerous calls for appropriate models to cultivate talent in students.

In addition, practical classes lag far behind market demand. At present, practical courses mainly include experiment teaching, production practice, graduation practice, curriculum design and graduation design. Based on the features of the specialty and the requirements for students' practical ability, the whole practical course system lags far behind what is required for social and economic development, and it cannot meet the requirements for community-oriented personnel specialised in electronic technology, automatic control and intelligent control, computer and network technology, and other electronic information related specialties. There is an urgent need for high-quality, innovative, senior engineering and technical personnel with all-round development. In addition, the current electronic information specialty curriculum in China fails to enable students to grasp the necessity for continuing education. Compounded with that problem are the insufficiently-innovative teaching contents and methods at some colleges and universities that do not correspond to the changing needs and demands.

The Theoretical Courses of Electronic Information Specialty Have Poor Linkage with Practical Courses

The practical courses of the electronic information specialty in colleges and universities are independent of theoretical courses [2]. Practical courses focus on training students' comprehensive vocational ability. The curriculum includes courses at three levels: basics, integrated design, and research and innovation [3]. Theoretical courses focus on students' basic theory and basic knowledge. Because practical courses and theoretical courses are carried out separately, the purely theoretical knowledge cannot improve students' learning interest, and it fails to consolidate students' basic knowledge about electronic information. Hence, teachers have to repeat theoretical knowledge in practical courses, thus, affecting students' hands-on ability. The practical course is slow-paced, and the various knowledge points are not well connected, which is caused by poor linkage between the theoretical courses and practical courses in the electronic information specialty.

Colleges and Universities Treat Practical Courses as Low Priority

Practical teaching includes many aspects, such as the establishment of a practice teaching base or configuration of various experimental devices in the teaching process. However, in the actual application process, many colleges and universities attach little importance to the teaching facilities and resources of the electronic information specialty, and there is no specific investment in this area. As a result, several problems emerge in the actual teaching process, such as insufficient teaching resources and the teaching imbalance between theory and practice [4].

Currently, colleges and universities strongly advocate using advanced and up-to-date equipment and resources for teaching, but because most of these devices are expensive, educational institutions do not have sufficient funds, and they are likely to face the problem of inadequate computers and equipment in the teaching process of this speciality.

Teachers' Comprehensive Ability is not High, and Teachers Fail to Pay Enough Attention to the Integrated Curriculum System

In the teaching process of the electronic information specialty, institutions should strengthen the integration of electronic information specialty resources. This should be done in order to improve the educational philosophy and education methods, as well as improving teaching efficiency [5]. However, in higher education, teachers fail to pay enough attention to the integration of electronic information specialty resources, fail to integrate effectively electronic information specialty resources in picture, text and other forms, and fail to use efficiently various e-learning resources.

Students, therefore, still follow the traditional learning methods, which often fail to stimulate their learning interest. Due to the impact of traditional teaching philosophies over a long period of time, some teachers have overemphasised theoretical teaching in the classroom, and have ignored the cultivation of students' engineering capability. In practical teaching, some teachers attach equal importance to the comprehensive curriculum design with a general experiment or independent experiment course. However, others disregard the teaching objective of comprehensive curriculum design, resulting in a situation in which the curriculum fails to exert fully its functions in regard to talent cultivation. Moreover, some teachers neglect the cultivation of students' comprehensive quality, and students' communication skills, writing ability, social adaptability and innovation ability are not fully developed.

THE PROPOSAL AND APPLICATION OF THE TSEI TEACHING MODEL

In view of existing problems in teaching the electronic information specialty, the author proposes that the *TSEI* teaching model be used more widely. The TSEI teaching model refers to a teaching model that combines the teacher, student, experiments and innovation. It is currently an effective education innovation model for the electronic information specialty under a market-oriented environment [6]. By improving teaching methods and aligning the teaching with market demands, it can promote and optimise students' practical ability and creativity.

TSEI Talent Cultivation Objective

Market-oriented electronic information engineering personnel have scientific, engineering and technical skills and work successfully for enterprises. They not only need to have solid theoretical knowledge, but also need to have a proper understanding of experimental methods and innovation ability. Therefore, the objective of the electronic information specialty is the cultivation of talent, and more specifically, it is to play a leading role in the learning process, by cultivating students' practical and innovative abilities, and improving their employability and success in the workplace.

Construction of the TSEI Curriculum System

Developing a curriculum system that meets social demand is an essential part of cultivating market-oriented innovative talent. The author has analysed the nature of the electronic information specialty, and established that the specialty is strongly practical and almost every course involves some kinds of experiment. Therefore, in addition to increasing students' professional knowledge in the teaching process, institutions should pay special attention to students' experimental ability, and strive to achieve integration and balance between experimental teaching and professional knowledge. Based on this teaching philosophy, institutions can integrate and optimise relevant courses in the electronic information specialty, and establish an electronic information curriculum group.

The electronic information curriculum group proposed in this article includes a basic theoretical course, application course, training course, innovation ability course and an experiment course. These courses are designed to enable students to grasp fully the basic theory and application scope of electronic information specialty, and achieve proficiency in the relevant software and hardware platform.

As shown in Figure 1, courses in the curriculum group have close linkages. The basic curriculum group teaches students the basic principles, and the correct use of experimental methods and laboratory equipment. The training curriculum group is designed to enhance students' hands-on ability and independent experimentation ability by using circuit diagrams, drawing, programming application, electronic component selection, soldering and small-scale circuit applications. The professional application curriculum group mainly cultivates students' analytical and application ability for small systems. The innovative ability experiment curriculum group mainly guides students towards acquiring advanced knowledge and developing their creative thinking.

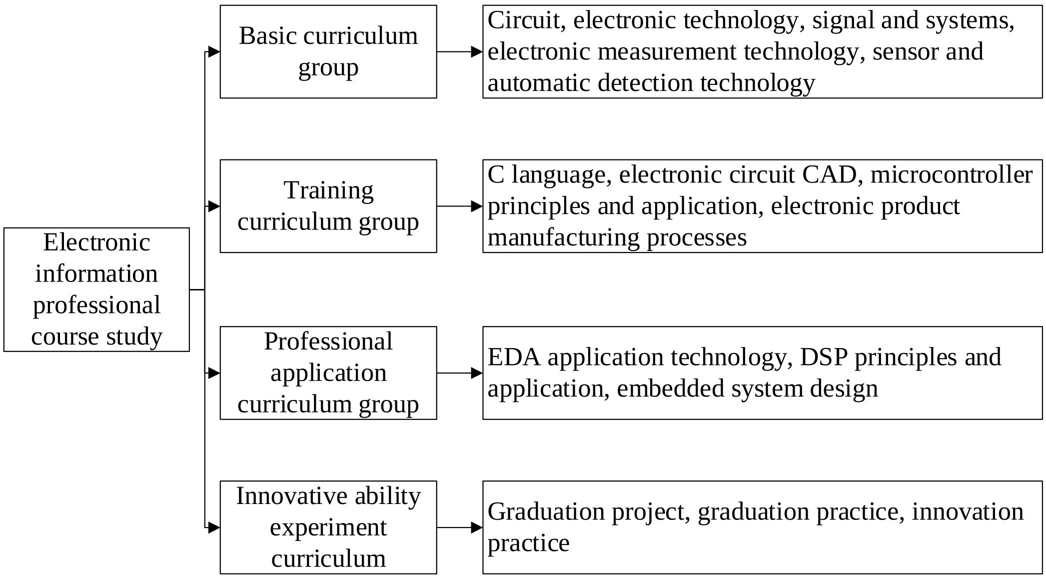

Figure 1: Structure diagram of electronic information specialty curriculum group.

Innovation of TSEI Teaching Methods

With the development of the market economy and electronic information technology, society has raised new requirements for electronic information education [7]. The electronic information specialty requires students to have a solid theoretical foundation and acquire rich experimental experience. Therefore, the author proposes that the TSEI teaching model should be used to empower courses with *innovative* electronic information practices, and more specifically that the model includes innovative experiment teaching content, establishes development laboratories, and combines laboratory work with academic competitions.

Experiment teaching content innovation: experiment teaching content innovation can effectively solve the problem of traditional experiment teaching, such as lack of comprehensiveness and design originality. Content innovation includes two aspects: firstly, it enriches the original experiment project by offering compulsory experiments and optional experiments, so that students can acquire in-depth knowledge by conducting optional experiments after completing compulsory experiments. Secondly, it establishes a new experiment project, extracts some content from teachers' research work or projects, and implements it as a comprehensive and purpose-designed experiment. These experiments have certain practicality and will attract students. They may stimulate students' learning motivation, enhance their initiative to study and promote the development of creative thinking.

Establishing a development laboratory: institutions should establish an open laboratory management system in addition to normal experiment teaching, so that students can choose to do some experiments in the laboratory in their own time, design experiment projects, apply for experiments according to their interests and hobbies, participate in teachers' research projects, and do some experimental work under the guidance of teachers. In the open laboratory environment, students can give full play to their initiative and develop hands-on ability, which is conducive to the cultivation of innovative talent.

Curriculum model that combines innovation laboratory work with academic competitions: the Creative Laboratory is under the management of the Institute of Electronic Science and Technology Association of the Inner Mongolia Electronic Information Vocational Technical College. The College provides some instruments and equipment, and students with spare capacity can undertake experimental and scientific work there. In this open laboratory environment, students can search for information, analyse problems and carry out practical works by themselves. This approach can greatly improve students' interest and ability, and is an implementation of the teaching idea of *learning by doing* [8].

Through innovative laboratory experiments, students with more in-depth knowledge of basic theories and hands-on ability can be selected to participate in academic competitions. Teachers assign tasks to students or discuss and analyse problems with them in the counselling process, until the problems are finally settled, thus, realising an interactive teaching mode [9]. In this process, students can fully appreciate the teacher's rigorous experimental attitude and academic spirit, modify their own attitude towards experiments, broaden their professional knowledge, and enhance their sense of innovation and teamwork.

TSEI Teacher Appraisal System

The TSEI teacher appraisal system means that teachers show full respect for students in the teaching process, highlight the central position of students, consider students' learning results and student employability, and overcome the one-sided problems of the traditional evaluation system. The TSEI system focuses on qualitative and quantitative indicators, addresses both the teaching and learning processes, and effectively promotes the teaching quality of the electronic information specialty.

A long-term incentive system should be adopted to ensure the full implementation of TSEI teacher training. Institutions should develop and implement their specific TSEI teacher appraisal system, and combine the institution's development with the teachers' self-development. They need to find a balance between competition and cooperation, and fully mobilise the enthusiasm and creativity of teachers, in order to provide strong impetus to support the curriculum construction of the electronic information specialty.

ANALYSIS OF THE IMPACT OF THE TSEI TEACHING MODEL ON THE TEACHING OF ELECTRONIC INFORMATION SPECIALTY

The TSEI-based teaching method has had a significant impact on the curriculum of the electronic information specialty at the Inner Mongolia Electronic Information Vocational Technical College. The students who majored in the electronic information speciality at the College were taken as research subjects. Two classes of students in Grade 2011 were selected. Each class had 35 students.

One class was nominated as a control group (referred to as the ordinary class) and the other class formed an experimental group (referred to as the experimental class). The traditional teaching mode was continued for the ordinary class, and the TSEI talent cultivation method was adopted for the experimental class. After the experiment results are discussed below.

Firstly, the course completion rate of students in the experimental class has improved significantly. The course completion rate of students in the experimental class was 96%, while the course completion rate of students in the ordinary class was 75%.

Secondly, students in the experimental class obtained more awards in various competitions. As shown in Figure 2, students in the experimental class won three awards at national electronic design contests and 35 provincial awards, while students in the ordinary class won one award in a national electronic design contest and 13 awards in provincial contests.

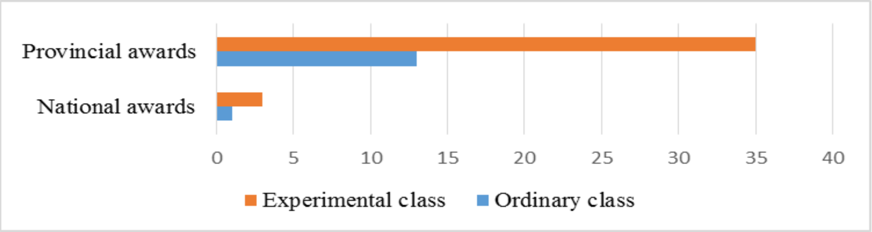

Figure 2: Comparison of award-winning students majoring in electronic information, Grade 2011.

Thirdly, the employment rate of students in the experimental class increased and reached 90%, while the employment rate of students in the ordinary class was 68%.

In summary, after adopting the TSEI teaching model, the students majoring in the electronic information specialty at Inner Mongolia Electronic Information Vocational Technical College have significantly higher rates of completion, award-winning and employment. The results indicate that this teaching model can improve students' comprehensive ability, and have a positive influence on the teaching of the electronic information speciality.

CONCLUSION

The author considered students majoring in the electronic information specialty at Inner Mongolia Electronic Information Vocational Technical College, analysed the tests results of two classes of Grade 2011, and established that the TSEI talent cultivation mode makes a significant contribution to the cultivation of talent in the electronic information speciality, as this training method increases students' practical ability and improves graduates' employability and development potential.

The TSEI talent cultivation model is different from the traditional *elite* training model. In order to meet the strategic requirements of large-scale enterprises for skill-oriented personnel, the TSEI model addresses the multifaceted development of students in a more systematic way than conventional cultivation modes do. Also, the TSEI teaching model is of great significance for institutions as it integrates the teacher's professional knowledge of electronic information specialty with the need to experiment, innovate and enable practical skill acquisition.

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