Research on the Innovative Practice Teaching Mode of Applied Undergraduate Digital Electronic Technology Major Based on the Computer Aid

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Abstract. Through a detailed analysis of the problems in the training of domestic applied undergraduate digital electronic technology majors, combined with the school's digital electronic technology major practical teaching innovation mode and reform measures, to explore effective methods and approaches for applied undergraduate digital electronic technology major practical teaching, in order to build a practical teaching innovation model that can effectively train students’ performance analysis, design and application.

Keywords: Applied Undergraduate, Electrical Major, Practical Innovation Ability

1. Introduction
With the rapid development of social economy and culture, the living standards of the general public continue to improve, and people's desire for higher education is also rising. The enrollment scale of higher education institutions is expanding year by year; at the same time, with the strategy of the national economy and industrial structure and the rapid development of high-tech industries, the society urgently needs a large number of high-level applied talents with both knowledge and skills. In this context, applied undergraduate education as a new concept began to be put forward and put into practice. Applied undergraduate colleges are aimed at cultivating high-level technical and applied undergraduate talents. The training of talents is based on practical application and oriented towards serving local economic and social development. The training of applied undergraduate engineering and technical talents is not only different from the training of undergraduates in key universities in general concepts, but also from the training of purely skilled vocational students. It must emphasize the importance of basic theoretical knowledge and strengthen the application of knowledge and Cultivation of basic skills. Therefore, on the one hand, we must master relatively solid basic theories, while at the same time we must strengthen practical teaching. As a key specialty in Zhejiang Province, the mechanical engineering and automation major of Wenzhou University, we clearly put forward the goal and positioning of the application-oriented undergraduate mechanical professional training: based on "enterprise demand traction, discipline development promotion; strengthening basic education, broadening professional orientation; optimizing course structure , Deepen the reform of content; strengthen practical training and focus on ability training. Under the guidance of the
professional construction ideology of "machine-oriented, electromechanical integration", while strengthening the training of students’ design capabilities and manufacturing process capabilities, in the process of mechanical design and manufacturing, the comprehensive ability training of electronic control technology, numerical control technology and computer technology is used; practical links are used as a bridge to closely integrate theory and practice to complete the basic training of talent training.

In view of the above-mentioned positioning and goals, in the process of training applied undergraduate mechanical professionals, the most important link is the cultivation of students' engineering practice ability. This article takes the teaching reform and research of the practical teaching link of our school's electrical majors as an example, and strives to explore effective ways and methods for the training of applied undergraduate professionals, and build a practical teaching system that can effectively train students' analysis, design, application, and innovation capabilities.

2. General ideas for the reform of practical teaching in electrical majors

Electrical disciplines are the pillar disciplines of national economic development. Applied undergraduate electrical majors are oriented to production practice and engineering technology development, and cultivate senior engineering and technical personnel with strong practical ability and certain innovation capabilities; it combines traditional electrical and electronic technology, automatic control, computer, network communication, information processing and other new technologies. The combination of technology has the characteristics of organic integration of multiple disciplines and cross-combination. The theoretical teaching and practical teaching are closely integrated, and the requirements for practical teaching are very high. Compared with many similar universities abroad, my country has not yet formed an applied undergraduate talent training model that is compatible with the characteristics of application development talents. The practical teaching system of applied undergraduate electrical majors is still being explored. The teaching plans of most schools are based on the original Based on the same professional college model and revised with reference to the teaching plan of the old engineering school, it has not fundamentally changed the original teaching model and established a practical teaching system for application-oriented undergraduate student ability training.

In order to better cultivate application-oriented talents that meet the needs of modern social economic development and industrial transformation and upgrading, our school is in accordance with the educational concept of "knowledge and action" in the formulation of the electric professional talent training plan, especially the practical teaching system design Students' cognitive laws, pay attention to the cultivation of students' basic engineering qualities, professional basic experimental skills, and scientific and technological innovation capabilities, and establish an integrated experiment that integrates scientific analysis ability training, engineering practice ability cultivation, comprehensive design ability cultivation, and innovation practice ability cultivation The teaching platform has formed a hierarchical, systematic and open practice teaching system with improving practical ability as the core, engineering training as the basis, and innovation ability cultivation as the focus, and actively exploring to cultivate adaptation for electronics, communication and information majors The development of modern electronic information technology requires high-quality application-oriented talents.

3. Reform of the practical teaching system for electrical majors

3.1. Reform of experimental teaching content

3.1.1. Reform the curriculum system and increase the proportion of practical teaching credits

In traditional comprehensive universities and universities of science and engineering, students choose to continue their studies after graduation. Therefore, when designing teaching plans, they generally pay more attention to cultivating students' solid mathematical foundation and professional theoretical
accomplishment, while practical teaching links. The proportion of credits is relatively low. For example, in the guidelines for formulating the undergraduate teaching plan of the University of Science and Technology of China, the proportion of credits allocated for concentrated practice teaching is only about 8% (as shown in Figure 1), and other similar universities in China are basically the same.

Figure 1. The credit allocation ratio of the undergraduate teaching plan of the University of Science and Technology of China.

For applied undergraduate colleges and universities, especially those that have just been upgraded to undergraduates, most of the students' destinations after graduating from undergraduates are to go directly to work positions, and the proportion of students who continue their studies is relatively low (usually about 10-20%). Therefore, while laying a deeper theoretical foundation for students, it is particularly important to improve students' practical ability, strengthen students' basic engineering training, cultivate students' innovative ability, and narrow the gap between students' professional quality, ability composition and employer expectations. Therefore, increasing the proportion of credit allocation in experimental teaching or practical teaching has become an inevitable choice for applied undergraduate colleges, especially for science and engineering majors. Based on this understanding, after extensive research and demonstration, when formulating the electrical professional teaching plan, we appropriately reduced the theoretical teaching hours and increased the proportion of the practical teaching link. The credit distribution ratio of the practical teaching link exceeded 20%. Table 1 is our school’s electronic science and technology major credit hour and credit allocation table.

Table 1. Electronic science and technology major class hours and credit allocation table.

| Course nature | Course category              | Theory class hours | Credit | Proportion |
|---------------|------------------------------|--------------------|--------|------------|
| Compulsory course | Public basic course          | 1032               | 59.5   | 32.3%      |
|                | Professional Basic Course    | 640                | 40     | 21.7%      |
|                | Professional Course          | 320                | 20     | 10.9%      |
|                | Practical teaching           | /                  | 38.5   | 20.9%      |
|                | Public elective courses      | 224                | 14     | 7.6%       |
|                | Sexual electives             | /                  | 8      | 4.3%       |
|                | Comprehensive quality        | /                  | 4      | 2.2%       |
|                | Total                        | 2216               | 184    | 100.0%     |

3.1.2 Reform experiment content, add experiment courses, and strengthen design experiments

In the entire practical teaching link, experimental teaching is the highlight. Experimental teaching takes the cultivation of students' application ability, design ability and innovation ability as the starting
point, and is the basis for cultivating students' practical ability and innovation ability. Professional experiments can be divided into three levels: confirmatory (demonstrative) experiments, comprehensive experiments and design experiments.

At present, due to restrictions on class hours, laboratory conditions, and teachers, most colleges and universities have relatively few comprehensive and designed experimental courses when arranging teaching plans. To this end, while increasing the proportion of credits in the practical teaching of electronic science and technology, on the one hand, we have drastically reduced the proportion of verification experiments in professional courses and increased comprehensive and design experiments. For example, on the basis of the original "circuit experiment" and "electronic experiment" courses, separate columns such as "electronic circuit design experiment", "electronic materials and components experiment", "optoelectronic technology experiment" and "electronic design competition guidance and training" are set up. The experimental courses strengthen students' practical application ability of electronic circuits, optoelectronic technology, electronic materials and components, and lay a good foundation for the cultivation of design ability and innovation ability. For example, the "Electronic Circuit Design Experiment" course is a comprehensive experimental course set up after the completion of "digital circuit" and "analog circuit" in order to further strengthen students' ability to design electronic circuits. Its content includes the design and debugging of numerically controlled constant current sources, the application of operational amplifiers in waveform transformation, the design of double-integral A/D conversion circuits, etc. Through this course, you will understand the general methods of electronic design, and be proficient in the use of conventional electronic instruments and the selection of electronic components. Lay the foundation for the cultivation of. On the other hand, curriculum design, comprehensive design, etc. all adopt design experimental methods, try to implement project education and goal-driven practical teaching mode, so that students are doing middle school, teachers provide goal tasks, implement guidance, and design Check and comment on the results of the experiment, thereby increasing the students' experience in designing and developing products, and strengthening the students' comprehensive application of professional knowledge to analyze and solve problems.

3.1.3 Reform the construction model of experimental conditions, encourage independent research and development of experimental equipment, and promote the roughening of experimental equipment

Experimental environment and equipment conditions are an important basis for achieving professional training goals. The current experimental equipment produced by various experimental equipment manufacturers generally have the following defects: ① The experimental equipment is inconsistent with actual engineering applications. The electronic circuit hardware used for student experiments has been welded. In the experiment, the experiment task can be completed by simply plugging in a limited circuit; the simulator is directly set in the experiment box, and the simulation software is also a special software developed by the experiment manufacturer. The schematic diagram of each module is not provided. In the experiment, students only need to connect the nodes mechanically according to the requirements in the instruction book and enter the program to complete the experiment task. This kind of experiment is very different from the design environment in actual work. The ability that students obtain through experiment is very limited, which seriously affects students' further understanding of professional knowledge, application ability and innovation ability. ② The experimental equipment is large and complete. In order to advertise the superiority of their products and meet the various needs of different schools, various manufacturers included a large number of experimental contents in the experimental device, resulting in a substantial increase in equipment prices, a large number of experimental resources idle, and unnecessary waste of experimental funds. ③ Insufficient advancement of experimental equipment. The application of traditional electronic devices is widely used in experimental equipment, and there are serious deficiencies in new devices and new standards. For example, the lack of LCD display control, high-speed AD conversion, I2C bus, SPI bus, CAN bus and other new device standards in the single-chip experiment box Various applications.

Based on this, we pay attention to the principles of adequate, practical and consistent with
engineering design in the construction of professional laboratories. We have developed a series of experimental devices such as single-chip microcomputer experimental platform and electronic circuit design experimental platform through cooperation with manufacturers or independent research. These devices are primitive and rough. When students do experiments on them, they will face various unexpected situations, which greatly improves the experimental effect and achieves good results in the students' application ability training.

### 3.2. Reform of practice teaching methods

The practical teaching of electrical majors generally includes course experiments, craft practice, course design, academic year thesis and graduation design. According to the characteristics of the profession, small-class experiment teaching is an important means to ensure the quality of teaching for professional curriculum experiments and curriculum design based on application, design and development.

The application, design, and development experiments of professional courses have high comprehensive requirements. Students must involve the content of multiple chapters in a course in the experiment, and even involve the content of multiple courses. Students have problems in the experiment. There are many, and this kind of experiment is the focus of cultivating design and application ability. According to the traditional grouping experiment model with class as the unit, it is difficult to complete all the experiments in the prescribed class hours, which leads many students to complete the experiment with little knowledge. In order to ensure that the purpose of the experiment is achieved, we adopt small class teaching for this type of experiment (usually 15 to 20 people conduct an experiment). The experiment is mainly a single independent experiment. The class time can be appropriately extended according to the experiment content, and students are required to do it. Good preparation before the experiment to ensure that the experiment can be completed independently.

The design of professional courses has become a combination of decentralization and concentration. At the beginning of the semester, professional course design tasks are assigned. There are about 3 people as a group. The topics of each group can be different, but they all have similar difficulty and workload requirements. During the theory teaching period, we will organize Q&A and progress check once a week, and conduct centralized design in the last two weeks of the term. Each group must complete the set design tasks. In order to ensure the quality of teachers' guidance and a certain amount of topics, each teacher instructs 15-20 students.

This goal-driven, decentralized + centralized training strategy is conducive to stimulating students' curiosity, giving full play to their subjective initiative, helping to ensure the quality of practical teaching, and achieving good results in practical teaching.

In addition to the prescribed practical teaching and training links, to cultivate high-level applied innovative talents, establishing an open laboratory is an important way. The core of open experiment is the openness of experimental content, that is, the experimental content and requirements are open, exploratory and innovative, allowing students to be free in the "open space" and use their brains spontaneously in free time to form an independent learning thinking mode. Open experiment is a comprehensive challenge to experimental equipment, experimental teachers and laboratory management. At present, our facilities and teachers are open to senior students in combination with the national college student electronic design competition training, accumulate experience, and gradually advance to the major; students choose topics in the open laboratory, and under the guidance of instructors, complete the design. The whole process of project development, such as production and debugging, fully trains students' ability to discover, analyze and solve problems.

### 4. Coordinate the second classroom teaching, take the electronic competition training as an opportunity to improve students' design and innovation capabilities

1. Construct a complete practical teaching system. According to the application-oriented undergraduate talent training goal, the practical teaching system we designed is divided into four levels, focusing on the cultivation of engineering practical ability. The first layer is course experiment,
with various course experiments as the main form, with the main purpose of cultivating students' basic skills, helping students to establish a rigorous and serious work style during the experiment process, so that they can obtain preliminary engineering concepts. The second layer is curriculum design, around the main line of design, craftsmanship, and manufacturing, almost every semester is arranged for curriculum design of related courses. Strengthen the connection between theory and practice through the course design of each link, and cultivate students' system design ability, comprehensive application ability and preliminary innovative practical ability. The third level is internship training. On the basis of mastering certain basic professional knowledge, students can exercise and improve their practical and innovative abilities by participating in internships in various links, so that students can fully understand the general process of enterprise production and broaden their majors. Vision, enhance students' understanding of society, national conditions and professional background. The fourth layer is physical production, including two teaching links of graduation design and physical production of mechanical and electrical products. Students are required to participate in the physical production of a mechanical and electrical product before graduation. Its main purpose is to train students to comprehensively use the basic theories, professional knowledge and basic skills they have learned, to improve their ability to analyze and solve practical engineering problems, and to strengthen the connection with production practices. The "real knife and real gun" make students receive a more systematic experience. Engineering practice training. The total credits of each link of the practical teaching in the practical teaching system have accounted for 30% of the total credits of the professional training plan.

(2) The teaching content of the practical link is combined with the local industry to meet the requirements of application-oriented talent training. The machinery manufacturing industry in Wenzhou mainly includes electrical appliances, automobile and motorcycle parts, shipbuilding, non-ferrous metal smelting, food and packaging machinery (including pharmaceutical machinery, printing machinery), Pumps, valves, general machinery and other seven major industries. Starting from serving the local economy and enhancing the employability of graduates: On the one hand, we cooperate with local enterprises to establish internship bases, arrange production internships to local enterprises to complete, increase students' practical opportunities and broaden their practical fields. Second, combine the topic selection of curriculum design with local industries. For example, in cartographic surveying and mapping, we use typical pump valve components as the surveying objects; in the course design of mechanical principles, the design of packaging machinery and printing machinery is the object; in the course design of molds, electrical appliances and automobile and motorcycle parts are selected as the design Object; the processing object of CNC technology practice is also pump valve parts. 3. 100% of the graduation design topic selection requirements come from local enterprises.

(3) Using subject competitions and student science and technology as a platform, the practice link of "mechanical and electrical products physical production" is added. At present, college students have many science and technology competitions, such as the National College Student Mechanical Innovation Design Competition, the National College Student Electronic Design Competition, and the National College Student Robotics Competition. National "Challenge Cup" college students extracurricular science and technology works competition, etc. Through subject competitions and student science and technology, students’ sense of innovation and innovative design ability can be improved, so that students can actively learn knowledge for solving practical problems, and change passive acceptance of knowledge to active acquisition of knowledge, so that students can use their theoretical knowledge as soon as possible. Solve practical problems, integrate with the actual production as soon as possible, and change the status quo that most of the design practice teaching of mechanical students stays on the drawings. Therefore, subject competitions and student science and technology have received more and more attention from universities, and they have been carried out in full swing in various universities, and more and more students have participated in them. In order to expand the scope of benefit and participation, combined with the characteristics of this major, we require students majoring in mechanics to pass discipline competitions, student science and
technology or graduation projects before graduation, and must participate in the completion of a physical production of mechanical and electrical products in order to obtain corresponding credits.

(4) Strengthen the cultivation of computer application ability. With the rapid development of computer technology and graphics technology, more and more computer-aided design software is applied to the research and development, design and manufacturing of enterprise products, and the application ability of computer-aided design software has been It is regarded as an essential professional skill for modern designers. However, faced with so many layers of design software, it also brings a certain degree of confusion and blindness to the teaching organization of colleges and universities, and even follows the trend. The teaching content lacks continuity and system. In addition, in the past teaching, the focus is mainly on software In the explanation of various functions, the combination of software functions and the application of professional knowledge is neglected, and the combination of software application and the professional curriculum system is neglected, which leads to the failure of students' mastery of computer-aided design software to achieve the expected results. Therefore, we combine the teaching of computer-aided design software with the practical teaching of this major, and continuously and systematically strengthen students' software application ability through practical links, expand students' professional skills, and enhance employment competitiveness.

5. Conclusion
After an in-depth analysis of the practical teaching of applied undergraduate digital electronic technology majors, I am willing to cultivate students' strong manual skills and ensure their advantages in future market competition. Systematic reform and construction can explore the practical teaching system of digital electronic technology for undergraduates, and form a teaching system centered on improving the practical ability of digital electronic technology for applied undergraduates to promote students' application ability.

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