Optimization and Practice on the Course Content and Teaching Methods of Optoelectronic Testing Technology

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Abstract. The research aimed at the characteristics and teaching requirements of the photoelectric detection technology course, optimized the teaching content and teaching methods of the photoelectric detection technology course, explored how to use scientific research results as the teaching content, and practiced how to put the new teaching method into the course and the teaching process. The practice has shown that the use of scientific research results in teaching is conducive to maintaining the rapid development of high and new technology and a dynamic atmosphere of the times; new teaching methods can improve students’ interest in learning and the quality of teachers’ teaching, and help to cultivate students' innovative consciousness and ability.

1. Introduction

As the Ministry of Education has issued guidelines for piloting the transformation of some local undergraduate colleges to applied technical colleges, "applied" will become a major development direction for many local undergraduate colleges in the future. During the transition period of colleges and universities, how to improve the engineering application ability of engineering students is particularly important. This requires the setting of the curriculum system, especially the reform of the teaching methods of each course. The brief framework of this technology is shown in Figure 1.

The photoelectric detection technology is based on optoelectronics, based on optoelectronic devices, and integrates optics, microelectronics, precision machinery, computer technology, and control technology. It is an important method for obtaining information based on light. The basis of research...
and development of integrated high-tech products of optical, mechanical, electrical and computing [1-3]. The course content is mainly to study the composition, working principle, characteristic parameters, basic circuit and practical application of various photoelectric devices. Its teaching is of great significance for linking the previous courses of optics, analog electronic technology and digital electronic technology and expanding the comprehensive application of knowledge. Therefore, the teaching and research of this course have been more and more valued by colleges and scientific research institutions, and it has become a required course for many undergraduate science and engineering majors, especially the basic education course for optoelectronic information science and engineering [1, 4, 5]. In the teaching process of photoelectric detection technology, how to supplement, update and optimize the teaching content according to the rapid development of photoelectric detection technology, organically integrate the development trend of photoelectric detection technology and cutting-edge technology into the teaching content [6], is an important topic to be discussed. In addition to being highly theoretical [7], photoelectric detection technology is also a highly practical course [5]. The course experiment is an important practice link in the course content. Students can not only verify the theoretical knowledge of books through experiments but also enhance their innovation and practical ability. In addition, shifting the focus of photoelectric detection technology from "focusing on teaching" to "active learning" in teaching methods is conducive to cultivating students' creative thinking and improving students' practical ability. This article mainly studies the optimization and practice of the photoelectric detection technology course content and teaching methods.

2. Characteristics of photoelectric detection technology courses

The photoelectric detection technology is based on the theories of optoelectronics, optical radiation, light detection, photoelectric effect, etc., through active or passive light emission of the detected target. After the optical radiation passes through the atmospheric system or transmission medium, it is received by the optical system and processed by the optical modulator Various types of photoelectric detection devices convert optical signals into corresponding electrical signals, and then use pre-amplification, filtering, bias, feedback, and other electronic circuits to process the processed electrical signals through A/D conversion and enter the computer system for processing, and finally, the corresponding physical quantity to be detected is displayed. As an emerging modern detection technology, photoelectric detection technology involves light, machine, electricity, computer, sensor, etc. It is extremely widely used and can detect all non-electrical quantities that can affect photoelectric or optical characteristics, high degree of automation and other characteristics.

The photoelectric detection technology course mainly involves four major parts: detection light source and lighting system, various types of photoelectric devices, circuit processing systems, and detection methods and systems. The main application areas involved are the measurement of radiometric and optical measurements, detection of the characteristics of optoelectronic components and optoelectronic imaging systems, detection of optical material elements and system characteristics, photoelectric detection of non-photophysical quantities, etc.

The requirements for students in the photoelectric detection technology course are divided into three levels of ability: basic, improvement, and synthesis. Basically refers to mastering the principles and characteristics of light sources and photoelectric devices, and familiar with the basic methods and systems of photoelectric detection; improvement refers to mastering the main parameters of photoelectric detection systems and the design ideas of photoelectric detection circuits; comprehensive refers to the use of knowledge Design a photoelectric detection system that meets the actual requirements. While students systematically learn the knowledge and methods of photoelectric detection technology, they can also be exposed to many applications related to photoelectric detection technology in daily life, such as photoelectric switches, fingerprint access control systems, automatic doors, automatic start and stop of escalators, X Light, infrared detection, etc. This makes the study of this course very grounded, and can more mobilize students' enthusiasm for learning.
3. Main problems in current teaching
Although the applied nature of photovoltaic detection technology courses is strong, in the traditional undergraduate education teaching process, many students are not interested in learning. This is not only the reason for students but also the teachers’ own reasons to a large extent. After analysis, we believe that the following problems exist in the current teaching.

3.1. Problems in classroom teaching

3.1.1. Emphasis on theory over practice. In the course of classroom teaching in local undergraduate colleges, subject to the constraints of traditional ideas, the teacher’s own educational experience, supporting textbooks, and the teacher’s own capabilities, there is a general emphasis on theory, practice, academics, and applications. Some teachers believe that the theoretical knowledge in the book is easy to explain, and teachers can use more effort, even if students consult on problems, they can also provide theoretical guidance; but practical teaching is different, based on the actual results of experiment and practice. The final verification goal, such as the design of the photoelectric counter system, if the teacher has limited ability, can not really guide the students.

3.1.2. Misunderstanding of subject status. In the traditional teaching process, "cramming-style teaching" is the most common phenomenon, and even the phenomenon of "the teacher speaks remarkably on the podium, and the students fall asleep on the seat". The reason is that there is a problem in the main position of teaching. Is it important for the teacher to complete the content of the book, or is it important for students to really learn the skills after the teaching process? University education is different from high school. High school is aimed at the final score of the college entrance examination. The purpose of university education is to train professional talent useful to society. Therefore, teachers in classroom teaching should play a more role as guides and mentors, the real subject is students. This is not only for teachers to think seriously but also for students' consciousness to be separated from the traditional education model.

3.1.3. Single teaching method. The traditional classroom teaching method of photovoltaic detection technology is relatively simple. Most colleges and universities still mainly use teachers to teach in the classroom, supplemented by PPT and blackboard writing, instilling the content that needs to be taught to students. This method ignores the students' receiving ability and initiative, and students often lose the kind of curiosity and interest at the beginning of the class because they feel that the teaching content is too abstract and messy.

3.2. Problems with practical teaching

3.2.1. There are many verification experiments and few comprehensive experiments. The experimental link of photovoltaic detection technology is to supplement, consolidate, and improve classroom teaching. It is the most cost-effective interactive link that combines the theoretical knowledge and practical application of the classroom. It will make the entire curriculum teaching system more complete. However, due to various reasons such as the limitation of experimental equipment, the limitation of teachers 'experimental development ability, and the mobilization of teachers' enthusiasm, the experimental content in the experimental link is outdated, there are many verification experiments, and there are few comprehensive experiments. The problem is in sharp contrast with the rapid development of photovoltaic detection technology.

3.2.2. The traditional assessment method is difficult to fully arouse students’ enthusiasm for learning. The traditional experimental assessment method is based on the student’s experimental results and experimental report. However, because the content and methods of the usual experiment are limited by a limited number of experimental equipment, it is difficult for the teacher to objectively judge each
member. The actual role played in the experiment, so there are some students rubbing the experiment phenomenon, students' enthusiasm for learning can not be mobilized well. On the other hand, the ultimate goal of teaching is to make students use it. Even if the discrete experimental links are learned, the comprehensive practical problems cannot be solved, and the teaching effect is not achieved. For example, the design of a multi-functional infrared anti-theft alarm system needs to The final assessment of the experiment is to arouse students' enthusiasm.

4. Theoretical Course Reform

The curriculum is an intermediary and link between teaching and learning. The theoretical classroom is an important place for teachers to teach and students to learn knowledge systematically. Teachers should sort out the teaching content, the interaction between teachers and students in the teaching process, and design the teaching methods and methods. All aspects should be studied and discussed.

4.1. Clarify the training goal of applied technical talents

The talent training objectives of applied technology universities are different from those of research universities. They should take students' future life development as the foundation and be guided by market and social needs, highlight the cultivation of application ability, strengthen the subjectivity, focus on differences, and highlight personal development and innovation. Cultivation of entrepreneurial ability.

4.2. Course teaching system optimization

4.2.1. Clarify the main teaching line and strengthen the application of knowledge. The photoelectric detection technology involves a wide range of knowledge and scattered. In order to avoid students from feeling "chaotic" in learning, we should comb the entire teaching mainline, for example, according to "light source-the measured signal and the formation of the optical signal-optical matching processing-photoelectric conversion (detection Device)-electric signal amplification and processing-output and control "line teaching, so that students can grasp the overall content of the course from a macro perspective. In addition, the typical application of a specific device and method is taken as the best touchstone of this knowledge point to guide students to reflect on what they have learned.

4.2.2. Sort out and choose scientific teaching content. In the teaching of photoelectric detection technology courses, the principle of focusing on basics and prominent applications should be followed, and the teaching tasks should be completed within limited class time. This requires teachers to make reasonable choices and focus on the content of the textbooks, and timely reflect the photoelectric The latest development of detection technology, such as the current barcode technology has changed from one-dimensional code to two-dimensional code. The theory and principle should be explained clearly. For example, the composition, principle, and parameters of the devices involved in photoelectric detection technology should be explained in detail; the previous courses such as bias circuits and preamp circuits based on photoelectric detection devices Let ’s talk a little bit about what has already been covered.

4.3. Improvement of teaching methods

4.3.1. Introduce multiple teaching methods to enhance teaching effect. Actively explore heuristic, participatory, and inquiry teaching, break through the limitations of traditional teaching models, and guide students' activities in teaching activities to enhance students' subjective initiative and cultivate students' creativity. When explaining thermoluminescence and thermal effects, students should be inspired to cite more typical cases to enhance the understanding of abstract concepts; when learning the basic differential system method in incoherent light detection, students can be guided to explore the advantages and disadvantages of this method in depth To see if there are other better alternatives.
In order to cultivate students' creativity in teaching, we must guide students to discover and raise problems, encourage students to explore and solve problems, support students' independent insights, and tolerate students' mistakes.

4.3.2. Clarify the status of students as the mainstay and give full play to their advantages. In teaching, the teacher's explanation and demonstration are necessary, but the purpose is to guide and demonstrate. The teacher's activities cannot replace the students' independent thinking and action operations. Only through their own active and independent thinking and practice can students flexibly master Knowledge, develop a good way of thinking and action, and internalize it into a personality quality. In the teacher-student exchange, if the student's personality is fully respected, every progress is praised, every positive development tendency is encouraged, and every factor that may translate into progress is cherished. Students' subjectivity can be fully exerted. Students should be encouraged to carry out in-depth analysis and thinking of common photoelectric detection systems in daily life to see what kind of parameter design and measurement methods are used to stimulate students' potential and cultivate students' comprehensive design capabilities.

4.3.3. Promote students with assessment reform and enhance learning enthusiasm. Strengthen the process assessment, weaken the phenomenon of a lifetime determination, strict standards, increase the proportion and weight of hands-on scores, can give students more opportunities, the focus is to check whether he has really mastered the knowledge through his own efforts, Not just remembered by recitation. Strictly manage the usual performance assessment, constantly improve the final exam assessment, enhance diversification, increase comprehensive questions, the difficulty of the question amount is reasonable, the scoring standard is objective, and integrate the examination content into the usual classroom.

5. Discussion on Practice Teaching Reform

In the process of training people for application-oriented undergraduates, special attention should be paid to the support of practical teaching and experimental links for personnel training. Without the experimental link, the theoretical knowledge taught to students cannot be translated into applications.

5.1. Change the emphasis on theory over practice, strengthen the role of practice

From school to school to every teacher, all levels should recognize the positive and irreplaceable role played by practical teaching in the cultivation of applied undergraduate talents. This is not just talking, but also highlighting the teachers' practice level in all aspects of the year-end assessment, job title assessment, etc., otherwise, it will become empty talk. Under the guidance of relevant school policies, teachers should strengthen the training of their own engineering practice ability. They should make full use of the weekend and winter and summer vacation time, use all possible opportunities, go to the enterprise to participate in technology research and development, production management, product testing, etc. Only after such accumulation can teachers' horizons be broadened, their abilities can be improved, and their guidance to students can be eased, so as to achieve the purpose of engineering training to feedback teaching.

5.2. Strengthen the construction of experimental hardware and provide a platform for student development

The practical teaching system plays an extremely important role in the training of applied talents, so it is very necessary and necessary to strengthen the construction of experimental hardware. The input of experimental hardware must focus on cost performance, which not only refers to the price but also includes reliability, durability, etc.; secondly, we must pay attention to our own development of experimental equipment; third, we must actively introduce advanced technical equipment and increase it in a planned and step-by-step manner. Such as CCD, 3D scanning and other mainstream technology equipment that students will use in the future, and at the same time avoid the disconnection between
teaching and actual production, so that students can fully understand and understand the applicability of the knowledge learned through the feedback and thinking of the results of experimental practice.

5.3. Based on science and technology projects, add comprehensive experimental links
Refining and designing targeted projects from various scientific and technological topics that teachers usually do, such as photoelectric car anti-collision systems, optical cube design, etc. As a supplement and extension of the experimental teaching content, it can effectively improve the quantity and quality of the weak comprehensive experiments in traditional experiments, which can not only make the experimental teaching keep up with the development of new optoelectronic technologies, but also help inspire students' scientific thinking. To stimulate interest in learning and improve the scientific research quality and ability of students.

5.4. Pushing students to practice innovation, adding extra-curricular innovation experiments
Based on the current mainstream domestic and international discipline competitions such as the National College Student Optoelectronic Design Competition, the National College Student Smart Car Competition, etc., to increase the intensity of students' practical innovation, special credit settings can be added to the teaching plan, open laboratories, and extracurricular innovation Experiment, actively encourage students to participate in various scientific and technological innovation activities, let students find, think, and solve some practical problems by themselves, and prompt them to go through a series of processes such as finding information, scheme design, analysis and comparison, mathematical modeling, experimental testing, writing reports, etc. to improve their design and comprehensive analysis capabilities.

6. Conclusion and future work
Applied technology universities are more prominent in the cultivation of talents, and the application of photoelectric detection technology is strong. It requires students to emphasize the hands-on ability of students on the basis of mastering more professional basic knowledge to achieve learning. Students should change the learning and thinking methods from a more theoretical course to a more practical one. Teachers should also design the course content, links, means, etc., with students as the main body of learning, so that students can learn knowledge. It should be applied to practice as the ultimate goal of teaching, not only to finish the lecture content but also to strengthen the input and connotation expansion of the practice teaching to enhance students' ability to solve practical problems.

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