



Discussion on the Teaching Improvement of Professional Basic Courses for Military Academy Students, Taking Non-electrical Measurement Techniques as Example

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Abstract. Professional Basic courses, serving as a bridge between basic courses and specialized courses, is very important to military academy students. However, those courses often have many complex theories and abstract concepts hard to comprehend, which to some extent affects the learning effectiveness of students. Focused on these problems, the professional basic course 'Non-electrical Measurement Techniques' is taken as an example, with the combination of previous teaching experience, practice and reflection including teaching content optimization, teaching team construction, organization form enrichment and teaching methods innovation and so on were discussed in this paper.

Keywords: Graduate student education; Professional basic courses; Teaching quality; military academy.

1 Introduction

Professional basic courses, a very important part of university education, serve as a bridge and link between basic courses and specialized courses. They lay the necessary foundation for the study of specialized courses and are essential for students to master professional knowledge and skills. However, those courses often have many complex theories and abstract concepts hard to comprehend, which to some extent affects the learning effectiveness of students^[1].

Based on the universal laws and experiences of similar courses, when teaching professional basic courses in military academies, it is also necessary to implement the new era military education policy of 'cultivating morality and educating for combat,' to target the characteristics of military academy students, to take the talent training goals of this major as the guide, and to support students in achieving the graduation requirements from three dimensions: knowledge, ability and quality.

On the basis of the teaching experience of the professional basic course 'Non-electrical Measurement Techniques', this paper mainly expounds measures to improve the teaching quality of professional basic courses in military academies from aspects such

as teaching content optimization, teaching team construction, organization form enrichment and teaching methods innovation.

2 Basic Information of the Course

‘Non-electrical Measurement Techniques’ is a compulsory course for the professional basic platform in the Aviation Maintenance Technology and Command major (Non-destructive Testing direction). It is one of the main courses of this major and is characterized by its strong theoretical, applied, and practical aspects. This course is offered in the fifth semester and based on the students' prior knowledge of ‘Electrical and Electronic Technology’ and ‘Automatic Control Principle’ which cover the basic theories of electricity and mechanics. The course focuses on the actual needs of the Air Force's weapon equipment, studying the basic characteristics of measurement systems, error analysis and uncertainty assessment of measurement systems, principles and techniques of sensors, and measurement methods for commonly used aviation non-electric parameters (such as rotation speed, temperature, pressure, vibration, flow, etc.). This course lays a solid foundation for the study of subsequent courses such as ‘Aviation Engine Control’ and ‘Aviation Maintenance Management’. It also provides direct support for students to apply their knowledge to solve issues related to the analysis, design, demonstration, and maintenance of aviation testing systems. Furthermore, it establishes a solid theoretical foundation for students to further engage in the research, management, and technical review of aviation equipment.

Through the study of this course, the aim is to achieve the overall goal of integrating knowledge, ability, and quality. At the knowledge level, students are expected to understand the basic principles and methods of non-electrical measurement, comprehend the working principles of commonly used sensors, and master the measuring principles of aviation parameters, etc. At the ability level, based on the actual equipment of the troops and the job position requirements, the course aims to cultivate students with strong practical skills, analytical skills, handling skills, and expressive skills. At the quality level, the course aims to cultivate students with a rigorous and realistic work style, good mechanics' qualities, and to inspire students' innovative awareness and dedication.

3 Practical Measures of Improving the Teaching Quality

In accordance with the teaching objectives and in conjunction with the characteristics of the course, this section introduces some practical measures to improve the teaching quality of the ‘Non-Electrical Measurement Technology’ course, mainly from aspects such as teaching content optimization, teaching team construction, organization form enrichment and teaching methods innovation.

3.1 Teaching Content Optimization

3.1.1 Emphasizing the Systematic and Standard Nature of Teaching Content.

As a compulsory course for professional foundations, it is essential to ensure the systematic and standardized nature of the course teaching content. During the teaching process, the optimization and integration of teaching content are carried out, adhering to the objective laws of education, reinforcing classic content, highlighting key points, enriching extended content, and strengthening the cultivation of students' practical abilities.

The teaching content is divided into three parts: Measurement Fundamentals, Principle and Technology of Sensors, and Aviation Parameter Measurement. These parts correspond to the theoretical foundation, principle foundation, and typical application foundation of the course. The theoretical foundation part mainly involves the analyzability of engineering signal measurability, the dynamic and static characteristics of measurement systems, and the error analysis of measurement systems. The principle foundation part mainly involves the principles and measurement circuits of resistive, capacitive, inductive, eddy current, piezoelectric, and thermoelectric sensors. The typical application foundation part mainly involves the measurement principles and methods of commonly used aviation parameters such as temperature, rotational speed, vibration, flow, and pressure in the aviation field.

3.1.2 Integrate the Actual Situation of Troops and Equipment to Enrich Teaching Content.

The future positions of military academy students have a clear directionality. During the study of professional basic courses, students have not yet established a complete concept and awareness of equipment. Introducing military or engineering application cases during the learning process can help students understand basic concepts and principles^[2]. Therefore, it is important to timely introduce new requirements of the troops and new technologies of equipment into teaching and into the classroom, to strengthen the directionality, pertinence, and effectiveness of teaching.

3.1.3 Integration of Teaching and Research to Enrich Teaching Content.

In the selection of teaching content, it is essential to fully reflect the integration of teaching and research, and to leverage the role of the teaching and research team, thereby ensuring the advancement and foresight of the teaching content. The instructors of this course are all engaged in high-level scientific research projects in related fields (such as National Natural Science Foundation projects), and incorporating the research findings of these projects into the teaching materials and classroom is conducive to enhancing the depth and breadth of the teaching content^[3].

Integrating the latest research achievements of the National Key Lab of Aerospace Power System and Plasma Technology into teaching and bringing them into the classroom can enhance students' interest in learning and improve learning outcomes. During the teaching process, the latest research results of the laboratory are introduced into the classroom, such as the results of the engine infrared radiation characteristics test, the

results of the pulse detonation wave pressure test, and the results of high-speed schlieren experiments, etc.

In response to the Ministry of Education's call for cultivating innovative talents at the undergraduate stage of higher education, students are encouraged to participate in high-level scientific research topics in the laboratory through plans such as the undergraduate mentorship system, which is beneficial for cultivating students' research capabilities and greatly benefits the teaching effectiveness of the course^[4].

3.2 Strengthen the Teaching Team

Teaching team is an important guarantee for the teaching quality and sustainable development of course^[5,6]. A variety of measures has been implemented to effectively enhance the level of the teaching team, such as: systematically selecting instructors to participate in activities like technical support and military assignments, which promotes their understanding of military combat training and familiarity with the combat use of equipment; supporting instructors to visit and exchange at well-known domestic universities like Tsinghua University and Beijing University of Aeronautics and Astronautics, to engage in academic research discussions and learn from the teaching experience of renowned universities; guiding and motivating instructors to innovate in thinking, strive for excellence, and develop in a diversified manner, thereby improving the overall teaching ability level of the team.

3.3 Innovative Teaching Methods and Approaches

The use of flexible teaching methods is an important guarantee for delivering a good course^[7]. In response to the characteristics of the course content in 'Non-electrical Measurement Techniques,' the instructors adhere to the teaching principles for undergraduate students and comprehensively apply various teaching methods according to different teaching content and classroom organization forms. In theoretical teaching, modern information technology and physical teaching aids are fully utilized, employing task-driven, problem-inquiry, and heuristic teaching methods to stimulate students' interest in learning. They actively advocate for diverse learning methods such as independent exploration, cooperative communication, and self-study through reading. In experimental teaching, the project-based teaching method is adopted with the project as the main line, the teacher as the guide, and the student as the main body, to enhance students' comprehensive quality and the effectiveness of practical teaching.

3.4 Enrich Educational Resources

Educational information and the digitalization of educational resources are important means to promote the high-quality development of undergraduate education^[8]. Actively apply modern educational resources to improve teaching effectiveness in the process of teaching 'non-electrical measurement techniques' course. Firstly, Optimize and enrich the teaching resources, update them promptly, continuously enhance the construction quality, and form effective support for the innovation and practice of multi-mode

teaching. Develop resources such as electronic textbooks, digital books, project databases, research reports, and sensor video animations, presented in the form of a course website for students to self-study after class. Optimize and improve the construction of traditional teaching resources such as courseware and laboratory manuals. Secondly, utilize resources such as National Quality Resource Sharing Courses to encourage students to engage in online learning. For example, resources from the ‘Sensors and Testing Technology’, ‘Sensor Technology and Application’, ‘Sensor Technology’, ‘Basic Engineering Testing Technology’, and ‘Testing Technology’ video open courses on platforms like the iCourse Network (<http://www.icourses.cn>) and the XuetangX Online MOOC Platform (<http://www.xuetangx.com>).

3.5 Improve the Course Assessment Methods

The course of non-electrical measurement techniques covers a wide range of knowledge points, which are diverse and complex. To reflect the true learning situation of students and to fully exert the role of evaluation in teaching, it is crucial to construct a scientific and reasonable teaching evaluation plan^[9]. According to the characteristics of the course, continue to strengthen the exploration and practice of diversified assessment models, and deepen the comprehensive application of formative and summative assessments. The course assessment includes two parts: formative assessment and summative assessment. Formative assessment mainly includes daily homework, course experiments, autonomous learning and classroom discussions, fully playing the role of the process assessment link to urge students to learn. Summative assessment is conducted in the form of a closed-book exam, using an automatic question bank for question setting, followed by teacher review to compile the exam paper.

4 Implementation Effect and Thinking

The training practice of the five sessions of undergraduates shows that this course stimulates students' interest in learning and guides students to form the habit of active learning, and students have solid basic theory and strong comprehensive ability.

Many undergraduates learning this course have chosen the undergraduate graduation project of related majors. The teaching content has played a good role in supporting and promoting the smooth implementation of the undergraduate graduation project. Some students have participated in the relevant scientific research projects in the laboratory after school, wrote academic papers and published them in journals. Through the course study, the students greatly improve their ability to learn, think and find problems and explore problems, and lay a good foundation for their future work.

5 Conclusion

In this paper, taking the undergraduate professional basic course of non-electrical measurement techniques as an example, practice exploration has been carried out to improve

the teaching quality. The measures mainly include teaching content optimization, teaching team construction, organization form enrichment and teaching methods innovation and so on. Practice shows that this teaching mode has achieved good results in mobilizing the enthusiasm and initiative of undergraduate learning and improving the quality of training.

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