

Research and Practice on Comprehensive Reform of Physics Specialty Construction of Applied Undergraduate Based on OBE Concept

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Abstract: In order to meet the increasing demand of national economy and social development for high-quality and innovative talents, the construction of majors is gradually getting the attention of colleges and universities, especially in the professional construction of application-oriented undergraduate colleges and universities. With the development of economy and society, the demand for undergraduate application-oriented talents has become very prominent. However, how to carry out professional construction in Application-oriented undergraduate colleges and universities and establish application-oriented majors that meet the needs of economy and society is a research topic with important practical significance. The Physics major occupies a very important position in colleges and universities, but based on the types of colleges and universities, the main task of application-oriented undergraduate is to cultivate application-oriented talents. It is oriented to the regional economy and society, and aims to cultivate high-quality application-oriented talents required by the economy and society. It has formed different characteristics from comprehensive universities in terms of teaching staff construction, teaching methods and experimental teaching. Taking the national first-class professional construction of physics in our university as an opportunity, combined with the application-oriented undergraduate, this paper proposes that under the concept of OBE, we should explore the professional orientation, guiding ideology, construction ideas and measures and results of the professional construction suitable for the training of application-oriented talents in physics in our university. These explorations have a good reference value for the construction of physics majors in applied universities.

1. Introduction

The physics major of our university was founded in 1958 and began to recruit students in the same year. It has a history of more than 50 years. As one of the earliest majors in the school construction, it has deposited high-quality resources for the construction and development of the school, so that the physics specialty has been well developed and made remarkable achievements. In 2008, physics was approved as a national characteristic specialty construction point and a characteristic specialty in Jiangsu Province. In 2011, physics was selected as a provincial key construction discipline. In 2013, physics was selected as a key specialty in Jiangsu Province. In 2020, physics was selected as a national first-class specialty.

For this reason, this paper has carried out a comprehensive reform exploration and practice on the construction of application-oriented undergraduate physics specialty. The first is to actively adapt to the needs of economic and social development. The second is to integrate the OBE concept with the background of application. The third is to strengthen the training of practical application ability and constantly improve the quality of talent training with the goal of cultivating application-oriented talents. The physics major of our university has been built into an undergraduate application-oriented talent training mode with advanced educational concepts, remarkable reform results and distinctive characteristics, and coordinated development of knowledge, ability and quality. At the same time, the demonstration and promotion effect of the physics major on the professional group has been clearly reflected, the professional strength of the professional group has been greatly enhanced, and the professional teaching conditions have been significantly improved; The performance of the innovation experiment and training base has been further improved, the knowledge, ability and

quality of students have been further improved, and the same majors in the same colleges and universities are at the leading level, and provide reference for the comprehensive reform of the same majors in the same colleges and universities both inside and outside the province.

2. Professional orientation and construction ideas

The application-oriented colleges and universities emerged under the transition and development of china's higher education to the popularization. It is different from academic universities and higher vocational colleges. It is mainly a brand-new type of colleges and universities with the fundamental goal of cultivating all-round development of application-oriented professionals. The professional development of application-oriented colleges and universities is to cultivate application-oriented talents with high quality and strong skills that meet the needs of regional economic construction and the overall development of society. It also attaches importance to the cultivation of students' professional practice and operation skills^[1-3]. According to the actual situation of regional economic development and application-oriented universities, scientifically and reasonably designing the professional structure and gradually increasing the strength of professional construction are important guarantee conditions for application-oriented universities to fully play their educational role and promote regional economic construction. Therefore, the establishment of professional orientation and guiding ideology of construction is the basis for the good development of a major^[4-6]. The physics major in the applied undergraduate colleges should establish the overall professional running idea of "taking the training of applied talents as the goal, taking quality engineering as the starting point, and serving the local social and economic development as the purpose". Its professional construction is implemented around the talent training specification and application-oriented talent training mode of "good ideological and moral character, solid professional foundation, strong practical ability and high comprehensive quality".

OBE is the abbreviation of outcomes based education, that is, the education mode based on learning output. Educators must have a clear idea of the abilities and levels that students should achieve when they graduate, and then seek to design a suitable educational structure to ensure that students achieve these expected goals. OBE education model can be considered as an innovation of education paradigm^[2, 6-7].

The physics major of our school adheres to the theme of being better and stronger. The first is based on the allocation of teaching resources and centered on curriculum reform. The second is to cultivate application-oriented talents with solid foundation, wide range of knowledge, strong ability, high quality, strong sense of innovation and strong ability to expand knowledge. The third is to strengthen teaching management. The fourth is to take the construction of teaching staff as a means. The fifth is the cultivation of professional ability. The sixth is to serve economic and social development based on market and social needs. In particular, it provides intellectual support and high-quality talent guarantee for the development of basic physics education.

3. Construction contents and effectiveness

3.1. Building a diversified training system based on the OBE concept to reflect the scientific, progressiveness, forward-looking and practical nature of the talent training program

As the guiding document of higher education, the undergraduate talent training program is the overall planning and design of the training objectives, specifications, training methods and contents, curriculum system construction and teaching plan arrangement of professional talents. The scientific talent training system directly reflects the progressiveness, foresight and active adaptability to the future society^[8-15]. Therefore, according to the development of economy and society, the physics specialty has revised the talent training program for many times from the perspective of quality education and innovation ability training. Based on the concept of OBE, the curriculum system of "platform and modularization" is established with the goal of developing application-oriented talents. The whole curriculum system consists of two platforms of general education and professional

education, and three curriculum modules of public foundation, professional foundation and professional direction. The basic physics course module mainly includes 9 courses of general physics (mechanics, heat, optics, electromagnetism, and atomic physics) and Theoretical Physics (theoretical mechanics, thermodynamics and statistical physics, electrodynamics and quantum mechanics). Among these courses, "electromagnetism and experiment" and "electrodynamics" are excellent courses in Jiangsu Province. A number of key course groups and network courses have passed the acceptance, comprehensively improving the teaching quality of basic physics courses and ensuring the realization of the training goal of physical basic rigidity. In order to continue to study for the advanced degree in physics, the course module to strengthen the study of the main courses in physics was selected. The module of strengthening the application of electronic technology is selected for students who work in companies and enterprises. The enhanced education course module is selected for students who are employed in the front line of basic education. The whole curriculum system strengthens the important link of practice and innovation education to achieve the training objectives of application and innovation. The course system of "platform and modularization" ensures the training of application-oriented talents with thick foundation, wide caliber, strong ability and high quality.

3.2. Constructing a "hierarchical, modular and professional" experimental teaching system

The physics experiment center relying on the physics specialty is a provincial experimental teaching demonstration center. The physics specialty has actively increased investment, the laboratory scale has been continuously expanded, and the teaching instruments and equipment are advanced and complete. The center adopts a hierarchical, modular and professional teaching mode according to the actual situation of different students. The experimental contents break the boundaries of force, heat, electricity and light in the traditional experimental teaching system, and break the boundaries between ordinary physical experiments and modern physical experiments. A new hierarchical physical experiment teaching system has been established, which is from basic to frontier, from accepting knowledge to cultivating comprehensive ability, and gradually improved. Moreover, the research-oriented experimental projects that can reflect the high-tech frontier and the scientific research achievements of our university are selected and optimized, which broaden the students' vision and improve their design ability and research ability.

a) Hierarchy: according to the purpose and requirements of the experiment, each experiment is divided into three levels: basic experiment, comprehensive design experiment and research innovation experiment.

b) Modularization: all experimental courses are divided into five modules: college physics experiment, basic physics experiment, comprehensive research physics experiment, normal teaching skills and university student scientific research innovation base.

c) Professionalization: for Physics (normal) majors, in combination with the requirements of the new curriculum reform of middle school physics for college physics experiment teaching, we should strengthen the training of students' solid experimental skills, explore the rules of experimental teaching, and strengthen the students' ability to demonstrate physical experiments and multimedia teaching.

Through strengthening practical teaching, in recent years, the construction and practice projects of the physics experiment teaching demonstration center have won the second prize of excellent teaching achievements of higher education teaching research in Jiangsu Province. Many innovative practice projects of physics majors have won provincial-level or above funding, and many graduation papers have won excellent graduation papers of Undergraduates in Jiangsu Province. In the national college students electronic design competition, he has won the national first prize and the second prize for many times. He has won the first prize and the second prize for many times in the Jiangsu University Students' scientific and technological papers and scientific and technological production competition.

3.3. Establishing the "simultaneous development of training and introduction" and creating a teaching team construction mode with "international vision"

The key to professional construction is to build a reasonably structured and high-level teaching staff. In recent years, the physics major has taken measures such as combining internal training and introduction, paying special attention to sending overseas famous universities and research institutions for research, and combining teaching with scientific research. These measures have optimized the overall structure of physics teachers. At present, there are 40 full-time teachers in physics, including 12 professors and 18 associate professors. More than 80% of the teachers have doctorate degrees. More than 10 backbone teachers have the background of studying in famous overseas universities such as the Massachusetts Institute of technology and the University of California at Berkeley. A teaching team with professors, associate professors and doctors as the main backbone has been formed. Among them, 5 were selected as the discipline leaders of the "333 project high level talent training project" in Jiangsu Province, 3 were selected as the academic leaders of the "blue blue project" in provincial colleges and universities, 8 were selected as the outstanding young backbone teachers of the "Blue Project" in Jiangsu Province, 8 were selected as the leading talents and top-notch talents of the "533 talent project" in Huai'an City, 2 were awarded the title of "teaching master" and 4 were awarded the title of "teaching model" in the University. Some celebrities won the first prize of the "young teacher teaching" competition, five won the second prize of the "young teacher teaching" competition, and four won the honorary title of "top ten teaching experts" of the school. In recent years, physics teachers have presided over more than 10 National Natural Science Funds, more than 30 projects at other levels, published more than 300 papers, including more than 200 SCI and EI, and applied for more than 20 invention patents. The theoretical physics teaching team has been rated as a provincial excellent teaching team.

3.4. Relying on key disciplines, organically combining discipline construction with specialty construction, and promoting the development of specialty construction

The physics discipline of our university is a provincial key discipline and a superior discipline of our university. The theoretical physics discipline echelon is an excellent discipline echelon of the "Blue Project" in Jiangsu Province. The theoretical physics discipline team is an excellent scientific and technological innovation team in Jiangsu Province. The physics discipline relies on the key disciplines, organically combines the discipline construction with the professional construction. Through the discipline construction, the faculty has been trained and strengthened, and a large number of scientific research tasks have been completed. The construction of key disciplines has improved the level of laboratories, experimental practice bases and equipment, formed a strong support for undergraduate experimental teaching, and greatly promoted the improvement of the teaching quality of physics application-oriented undergraduate majors. At present, the physics specialty of our university has been selected as a national characteristic specialty and a national first-class specialty, a characteristic specialty of Jiangsu Province and a key specialty of Jiangsu Province, and the physics experiment teaching demonstration center has been rated as a provincial demonstration center.

3.5. Stimulating students' interest in learning and improving teaching effect, and establishing diversified teaching methods and means

In order to stimulate students' interest in learning, in recent years, the physics major of our university has actively constructed the reform of teaching methods and means aimed at promoting students' knowledge innovation and ability cultivation according to the new ideas of higher education teaching reform and school education reform. The physics major of our university also actively promotes teaching research and practice such as inquiry and heuristic teaching. The use of these methods and means improves the teaching effect and promotes the further improvement of the quality of personnel training. The postgraduate admission rate of undergraduate students majoring in physics in our university is over 20% each year, and the employment rate of undergraduate graduates is over 99%.

3.6. Making full use of the talents and technical advantages of physics to actively serve local science popularization and economic construction

The physics major of our university makes full use of the advantages of high-level teachers and complete experimental equipment to strengthen the popularization of science and applied research. In addition to cultivating qualified application-oriented talents for this major, physics majors also provide science popularization and competition guidance for primary and middle school students in Huai'an City. The physics teachers of our school often organize students to carry out social service activities such as "physics in life" in the surrounding areas, which are warmly welcomed by the surrounding people. The physics major also signed long-term cooperation agreements with Jiangsu Ruite Electronic Equipment Co., Ltd., Huai'an Sanyi Electrical Equipment Co., Ltd., Jiangsu Aote Electrical Equipment Co., Ltd. and other enterprises to carry out technical services and product research and development for these units. In recent years, the professional teachers have successfully applied for 4 national Spark Program projects, more than 10 provincial industry university research cooperation research projects, 2 provincial university industrialization promotion projects, and nearly 20 Huai'an science and technology support projects, which have produced good direct economic benefits for the enterprise.

3.7. Improving the teaching management system and mechanism and increasing the teaching management performance

The physics major of our university conscientiously implements the OBE concept and improves the teaching management system and mechanism. We improve the management performance by improving the teaching management system and the teaching evaluation mechanism. First, we actively encourage and support teachers with high academic qualifications, high professional titles, teaching ability and high level to serve as professional leaders and principals, strengthen management ability training, and focus on improving management level in practice. The second is to implement the professional director system and build a three-level management mode of "College Department-course-director". The third is to strengthen the monitoring of teaching quality, adhere to the comprehensive supervision of teaching work, and adhere to the "one vote veto system of teaching work" and other teaching management systems.

4. Conclusion

Through the research and practice of the comprehensive reform of the applied undergraduate physics specialty in the applied undergraduate colleges, this paper will definitely make the school orientation of the applied physics specialty in the applied undergraduate colleges more clear, further strengthen the teaching ability, further improve the school running level, and further improve the management level. It is of great significance in personnel training, scientific research and social services. Specialty construction is the prerequisite and guarantee condition of talent training in Colleges and universities. In the future work, we will further implement the OBE concept, deepen the comprehensive reform of specialty construction, further improve teaching norms and management, optimize resource allocation, deepen the reform of experimental teaching, pay close attention to quality engineering, further increase the intensity of practical teaching, enhance the radiation function, and strive to create a new situation in the construction of applied undergraduate physics specialty.

References

- [1] Zhang Daliang. Grasp the work orientation of "school theme and local responsibility" and actively guide the transformation and development of some local undergraduate universities[J]. China higher education, 2015(10):23-29.
- [2] Xu Jin, Tu Zhongyin. Construction of evaluation index system of teaching style in local universities Based on OBE[J]. Journal of Jiaxing University, 2021, 33(3):1-5.
- [3] Song Yi, Jiang Dayong. Strengthening the construction of characteristic specialties and cultivating

talents to meet social needs[J]China higher education,2008(13):14-16.

[4] Cui Guosheng.Several problems to be solved in the transformation and development of local Universities[J]. Journal of shenyang institute of engineering,2016,12(2):213-217.

[5] Yang Chaohui,Zhang Wei,Zeng Guangming,et al Reforming experimental teaching in Colleges and universities and cultivating high-quality talents[J].Higher science education,2005(4):106-108.

[6] Wang Guohua,Wang Jianan.Teaching research and practice of basic courses of engineering education under the concept of OBE[J].Inner Mongolia Education,2019(9):6-10.

[7] Dong Meifeng.Exploration of teaching mode of college physics based on the concept of OBE and New Engineering[J].Higher education journal,2018(18):19-22.

[8] Zheng quehui.On the construction of characteristic majors in colleges and universities[J]. Education and occupation,2006(30):19-201.

[9] Song Yi, Jiang Dayong.Strengthen the construction of characteristic specialty and cultivate talents to meet social needs[J].China higher education,2008(13):14-16.

[10] Cui Yunyi,Wang Shaofei.Teacher professional development is the improvement of professional practice[J].Education research,2014(09):77-82.

[11] Guo Jianyao.Thoughts on strengthening specialty construction in local applied undergraduate colleges[J]. teaching and education,2012(36):7-9.

[12] Tian Yan,Li Jinsheng.Research on the practical teaching system of excellent applied talents[J]. education and occupation,2015(31):105-107.

[13] Ji Hong,Gu Yong'an,Zhang Genhua,et al.Innovation and creation from the perspective of training applied talents exploration of vocational education[J].Jiangsu higher education, 2016(04):77-80.

[14] Gao Xiuye.From elitism to Populism:the discourse of Cultivating Innovative Talents Practice turn[J]. Contemporary education science,2019(10):18-21.