

Application of Project Teaching Based on OBE Teaching Concept in Wireless Sensor Network Technology

Yanhong Chen^{1,a,*}, Feng Jiang^{2,b}

¹Shenyang Institute of Technology, Shenyang, Liaoning 113122, China

²Pera Global, Beijing, 100025, China

^a183971915@qq.com, ^b31891183@qq.com

*corresponding author

Keywords: OBE Concept, Reform in Education, Teaching Evaluation

Abstract: Under the background of "new engineering", in order to improve the training quality of applied talents, wireless sensor network technology, as the core course of Internet of Things engineering, must change the traditional teacher centered and content based teaching mode. Aiming at the problems existing in traditional teaching, this paper proposes teaching reform based on OBE concept. Under the teaching concept of OBE, with students as the center, "learning output" as the goal, and project implementation as the carrier, reform the curriculum system, teaching methods, curriculum assessment and other aspects, and expect to evaluate students' learning effects through a scientific evaluation system, and constantly improve the teaching quality.

1. Introduction

The key engine for the development of human society is the progress and innovation of science and technology [1], which requires a large number of new talents with sustainable creativity. If China wants to have sustainable development of social economy, it must cultivate a large number of competitive and sustainable innovative talents [2]. The source of talents is mainly higher education [3]. In order to meet the needs of current social development, it needs to adjust or reform the mode of higher education. In recent years, the Outcomes Based Education (Outcomes Based Education, OBE for short) has gradually emerged. Its core idea is to take students as the center and students' expected learning output as the guide, so as to implement and evaluate the teaching process and teaching effect.

Considering that students generally have weak practical ability [4], the wireless sensor network course is taught through "project practice"+"learning while practicing". In terms of teaching objectives, we should take the OBE concept as the guidance, adopt the software enterprise project practice teaching forms and means, fully mobilize and tap the potential of teaching and learning [5], especially strengthen the students' awareness of active participation. Through the "learning by doing" teaching method in project practice [6], we should comprehensively train and improve students' practical ability, expression ability and team cooperation ability, and cultivate and improve students' ability to find problems Ability to analyze and solve problems. OBE mode plays an important role [7] in promoting the reform of engineering education and improving the quality[8] of

engineering talent training, and has become the focus of extensive attention of local engineering colleges in China.

2. Problems in Traditional Teaching Ideas

2.1. The Curriculum Design Focuses on Positive Design, and the Curriculum Content is not Perfect Enough

The teaching of wireless sensor network technology course adopts the traditional positive design teaching mode, which focuses on teachers and textbooks, pays attention to the input of teaching content, and emphasizes teachers' teaching of learning content. From the curriculum system, the reverse process to the graduation requirements, to the training objectives, and then to the needs, the curriculum content precedes the curriculum objectives. In addition, most of the management norms and standards of curriculum content design are based on domestic norms and standards, and new technologies and methods are not introduced in detail. Traditional education can only "adapt" to the external needs of the country, society, industry and employers, but it is difficult to "meet". The curriculum lacks effective support for the achievement of graduation ability.

2.2. The classroom is Centered on Teachers' Teaching and Lacks the Cultivation of Students' Application Ability

In the traditional classroom, knowledge dominates the classroom, teachers are the center, teachers' "teaching" is emphasized, and students' "learning" is ignored. In the whole teaching process, students, as cognitive subjects, are always in a passive position. The initiative of students' learning is often ignored, lacking the stimulation of students' learning enthusiasm, and students cannot consciously and actively learn. The students' mastery of knowledge is still superficial, which is not conducive to the cultivation of students' application ability.

2.3. The Course Assessment Method Is Single, and the Evaluation Method is One-Sided

Wireless sensor network technology is a course with both theory and practice. In the learning process, students' individual differences will also lead to different gains after learning. Therefore, the final examination alone is not enough to reflect the students' "learning output" and application ability, nor to evaluate the teaching effect.

3. Teaching Reform of Wireless Sensor Network Technology Based on OBE Concept

3.1. Adopt Reverse Design and keep OBE Concept Throughout

Traditional education can only "adapt" to the external needs of the country, society, industry and employers, but it is difficult to "meet". Therefore, the course team of wireless sensor network technology adopts reverse design thinking [9], starting from the demand, the demand determines the training objectives, the training objectives determine the graduation requirements, and then the graduation requirements determine the curriculum system. Through the interview with employers and the follow-up survey of graduates, in combination with the latest needs of industry development[10], we understand the internal logic of wireless sensor networks and the promotion process with collaborative thinking, pay attention to the cultivation of students' application ability, expand their thinking and vision, and comprehensively develop students' innovation ability and collaboration awareness, laying a solid foundation for the work they are engaged in after graduation.

"Demand" is both the starting point and the end point, thus ensuring the consistency of educational goals and results to the greatest extent, as shown in Figure 1.

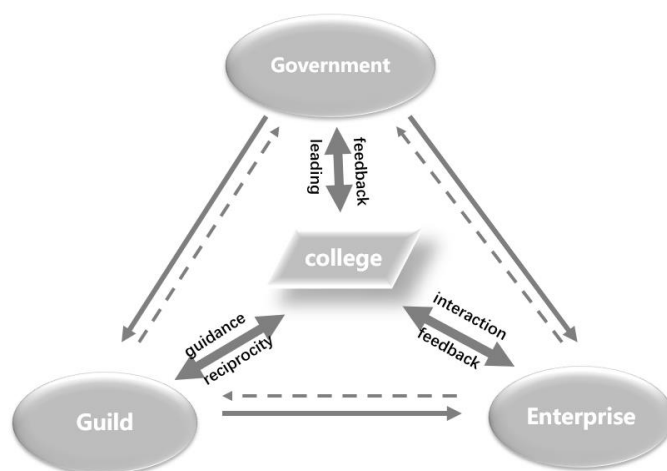


Figure 1: Trinity feedback mechanism.

At the same time, pay more attention to the development trend of the industry and the demand of the industry; Focusing on the national macro policies, based on the national strategy and industry development needs, constantly enrich and improve the teaching content, constantly introduce new technologies[11] in the industry and apply them in the classroom, constantly enrich the students' vision and vision, so as to better meet the needs of the industry [12] and better serve the society and the country.

3.2. Focus on Students' Practice in Class and Strengthen the Cultivation of Students' Practical Ability

Build diversified teaching methods. The traditional classroom is teacher centered, emphasizing teachers' teaching and content oriented. The teaching mode of OBE concept emphasizes student centered, student learning and practice oriented. A variety of teaching methods are used in class, such as cloud class and other information-based methods to carry out classroom tasks, homework, project implementation, stage testing and other teaching activities. In class, case teaching, situational teaching, course practice, group discussion and other methods are comprehensively used, so that students can truly become the center of the classroom, as shown in Figure 2.

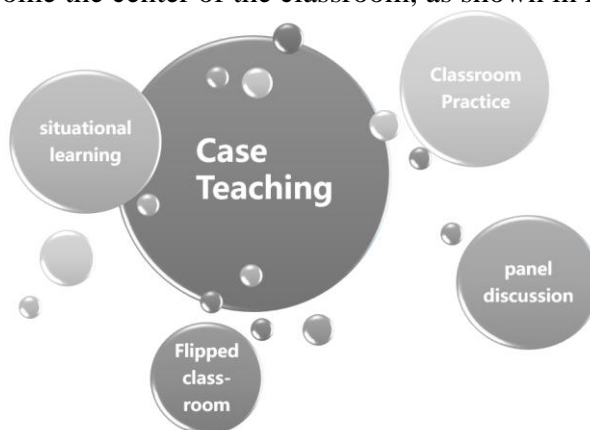


Figure 2: Application of various teaching methods.

Strengthen practice and cultivate students' practical ability. The course of wireless sensor network technology is both theoretical and practical. In the classroom teaching, the curriculum team and experienced enterprise engineers jointly discuss the curriculum reform scheme, take the enterprise level development project as the background, take the complete project as the carrier, and take each chapter as the development link, so that students can take the project task to learn from the beginning, let student groups cooperate to complete the project design and practice link, and learn while doing during the project implementation process, Combine theoretical knowledge points with practical operation to achieve the unity of theory and practice[13]. Focusing on project tasks and aiming at professional post ability, it runs through the whole teaching process and ensures the continuity and systematicness of teaching content, as shown in Figure 3.

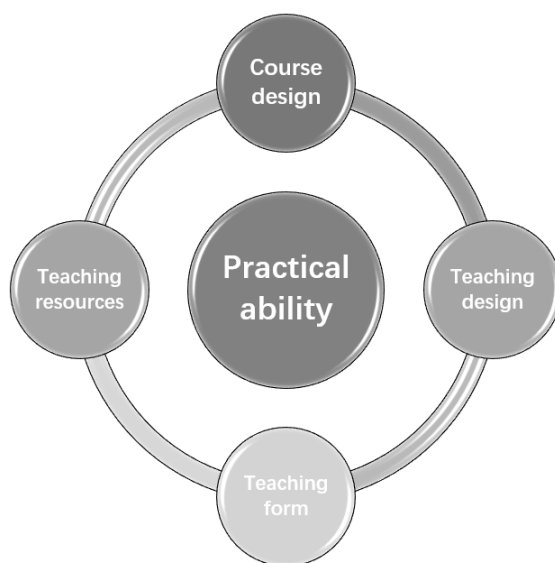


Figure 3: Designing teaching links around improving practical ability.

3.3. Establish Diversified Assessment Methods and Diversified Evaluation Methods

Teaching evaluation [14] is based on students' learning achievements, based on the achievement of teaching objectives, and serving the continuous improvement of teaching. The traditional teaching evaluation mainly focuses on teachers' "how to teach" teaching evaluation, breaks the single assessment method, establishes a diversified ladder for teaching evaluation, and emphasizes "continuous improvement" in the teaching process. Change the existing course assessment method based on final examination, increase the process assessment and practical ability assessment of students in the course learning process, and assess the learning effect and quality of students in the wireless sensor network technology course from multiple perspectives. Therefore, after the reform, the curriculum assessment is divided into three parts: usual assessment, process assessment and final assessment. Among them, the usual assessment accounts for 30%, which is carried out by homework, test and other evaluation methods, mainly to assess students' mastery of theoretical knowledge; The process assessment accounts for 30%, and the assessment is carried out by means of classroom tasks, project completion, etc., mainly assessing the students' hands-on operation ability and practical ability; The final examination adopts the final examination paper to comprehensively consider the students' understanding and application ability of wireless sensor network technology. Through the establishment of diversified assessment methods, students' learning and mastery of wireless sensor network technology courses can be considered from a

multi-dimensional perspective, and students' development level of theoretical knowledge, practical ability and professional quality can be comprehensively evaluated, as shown in Table 1.

Table 1: Wireless Sensor Network Technology Composition of Course Assessment Method

Assessment items	Proportion	Assessment composition
Regular assessment	30%	Attendance, operation and test
Process assessment	30%	Classroom tasks and project completion
Final exam	40%	Computer test

Establish a dynamic circulation mechanism to continuously improve teaching quality. The course team of wireless sensor network technology adopts PDCA cycle mechanism to formulate teaching plans, implement teaching plans, monitor teaching quality, evaluate and feedback teaching quality, improve the reform mechanism, and continuously improve teaching. In addition, we will conduct a questionnaire survey on students before, during and at the end of the class to investigate the implementation of various links in the teaching process, such as teaching design, classroom interaction, homework and testing, classroom tasks, project implementation, and course assessment; At the beginning of the course, students' understanding of the course is also understood. Through the study of the wireless sensor network technology course, students' completion of the goal is understood in the middle of the period, and students' mastery of the course is tracked at the end of the period. At the same time, based on the opinions given by the inspection and evaluation of the school and branch supervisors, the curriculum team held regular meetings and discussions to find out the deficiencies and fill in the gaps, make continuous improvement and improve the teaching quality.

3.4. Practical Application and Effect Evaluation

The research nature of the wireless sensor network technology course is at Grade 19 of the Internet of Things Engineering Major, with 69 people practicing, and currently it is at Level 20 of the Internet of Things Engineering Major.

In contrast, there are 68 students in Grade 16 of the Internet of Things Engineering major. The OBE teaching concept was not implemented in the teaching process. Students have no strong interest in learning by rote. However, after the implementation of the teaching reform, the effect of Grade 19 students is remarkable. The students have a serious and active learning attitude, can flexibly use the knowledge they have learned, and can express their research results in scientific and standardized terms of the Internet of Things. The overall score of the students has improved significantly, as shown in Table 2.

Table 2: Comparison of academic achievements of students in the Internet of Things Engineering major at Grade 16 and 19

Fractional distribution	Grade 19	Grade 16
90-100	14.49%	4.41%
80-89	34.78%	30.88%
70-79	42.03%	57.35%
60-69	8.70%	7.35%
<60	0%	0%

During the exploration and practice of the research-based teaching method [15] of this course, as direct participants in the practice, most students think that the research-based teaching practice of wireless sensor network technology is very successful, the students' ability of research-based learning has been enhanced, the team awareness and the spirit of cooperation have been increased, and good teaching results have been achieved through practice.

4. Conclusions

Wireless sensor network technology, as a professional backbone course of the Internet of Things engineering major, is also a professional elective course of electronic information engineering and other majors. It has been in the process of continuous development, especially the development of network technology directly affects wireless sensor network knowledge. Therefore, the theoretical knowledge of this course is difficult to teach and learn, and the traditional teaching mode cannot achieve good teaching results.

The course team of wireless sensor network technology adopts the project teaching based on OBE concept [16] to reform the course, implements the teaching concept of "learning output oriented" and "student centered", and takes the enterprise level project as the carrier. Aiming at the practical problems in the course teaching of wireless sensor network technology, the team proposes reverse design to reconstruct the course system, so that students can master the basic knowledge and methods of wireless sensor network technology, understand the basic engineering knowledge of wireless sensor network technology and consolidate theoretical knowledge. At the same time, it focuses on cultivating students' understanding of the analysis, design, implementation and solution of general engineering problems, and attaches importance to cultivating students' innovative thinking ability and team cooperation ability in the process of solving problems; We should attach importance to the cultivation of students' autonomous learning ability and the cultivation of students' autonomous learning methods. Finally, through the classroom of wireless sensor network technology, students can not only master a solid theoretical foundation, but also improve their comprehensive analysis ability and problem solving ability. In the future teaching process, it is still necessary to constantly try new teaching methods and means to improve students' innovation ability and practical operation ability, to achieve the training goal of application-oriented talents, and to adapt to the new needs of industry development.

References

- [1] Ruini Liu. (2022) *Practical Teaching Reform of Electrical Control and PLC based on OBE Concept*. *Curriculum and Teaching Methodology*, 5(3).
- [2] Qiao Yan, Fu Haiming. (2022) *Study on OBE Teaching Concept in the Context of Deep Learning for the Construction of University Mathematics Microcourses*. *Computational Intelligence and Neuroscience*, 2022.
- [3] BinRen, KangLi Lei, TingZhang. (2021) *Innovative Teaching Combined with 3D Printing Teaching Aids and OBE Teaching Philosophy*. *Proceedings of 2021 2nd International Conference on Electronics, Communications and Information Technology (CECIT 2021)*. 723-727. DOI:10.26914/c.cnkihy.2021.065502.
- [4] Tingting Cui, Daixin Feng. (2020) *Teaching Reform Practice of International Trade Practice Course based on OBE Education Concept*. *Proceedings of 2020 International Conference on Humanities, Arts, and Social Sciences (HASS 2020)*. 146-150. DOI:10.26914/c.cnkihy.2020.052056.
- [5] Weiguo Li, Xiaoying Zhong, Xiumei Wang, Xiao Chen. (2022) *Research on the Teaching Reform of Operation Management Course Based on OBE Education Theory*. *Curriculum and Teaching Methodology*, 5(12).
- [6] Guangcai Niu, Wenyi Wei, Dan Zhu, Yanjun Tang, Lei Zhu. (2022) *Teaching Reform and Practice of Storage and Processing of Fruits and Vegetables Curriculum Based on OBE Concept*. *Curriculum and Teaching Methodology*, 5(9).
- [7] Tian Zhi. (2022) *Analysis on the Embodiment of OBE in Cultivation of Business English Majors*. *Pacific International Journal*, 5(3).
- [8] Ning Liu, Xiaodong Zheng, Zhongtang Zhao, Haoqi Yue. (2019) *Research on Teaching Reform of Algorithm Analysis and Design Based on Obe*. *Academic Journal of Engineering and Technology Science*, 2(4).

- [9] Dandan Song. (2022) *Research on the teaching reform of Python programming curriculum based on the OBE-CDIO concept*. *Frontiers in Educational Research*, 5.0(11.0).
- [10] Jie Zhang. (2022) *Analysis and Construction of Software Engineering OBE Talent Training System Structure Based on Big Data*. *Security and Communication Networks*, 2022.
- [11] Mengying Lin. (2022) *Curriculum Reform of Employment-Oriented “Design of Machinery” Based on OBE Education Concept*. *Frontiers in Educational Research*, 5.0(9.0).
- [12] Qiao Yan, Fu Haiming. (2022) *Study on OBE Teaching Concept in the Context of Deep Learning for the Construction of University Mathematics Microcourses*. *Computational Intelligence and Neuroscience*.
- [13] Ruini Liu. (2022) *Practical Teaching Reform of Electrical Control and PLC based on OBE Concept*. *Curriculum and Teaching Methodology*, 5(3).
- [14] Guang Yu, Ernan Ju. (2022) *Innovation and Practice of Programmable Logic Controller Course Based on OBE*. *Frontiers in Educational Research*, 25.0(7.0).
- [15] Jun Luo, Shihua Xiao, Lei Chen. (2022) *Research on the evaluation system of practical Teaching Quality based on OBE concept*. *Computer Informatization and Mechanical System*, 5(1).
- [16] Cheng Kun Shi, Shi Cheng Kun. (2020) *The Improvement of Teaching Design Ability of Physical Education Major Based on Computer Media Scene Teaching Video Model under the Concept of OBE Teaching*. *Journal of Physics: Conference Series*, 1578(1).