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Reform of Robotics Engineering Practice Teaching in Applied Undergraduate Colleges and Universities Based on OBE Education

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Abstract: The modern society has put forward higher level requirements for the development of robotics technology, which also puts forward new challenges to the teaching practice of robotics engineering majors in applied undergraduate colleges and universities. In this paper, guided by the concept of OBE education, we discuss the reform strategies for the practical teaching of robotics engineering majors in applied undergraduate colleges and universities from the three aspects of project-driven learning, focusing on diversified assessment, and being practice-oriented. Through the implementation of these reform measures, students' practical ability, teamwork ability and problem-solving ability can be better cultivated, and their application level in the field of robotics engineering can be enhanced.

Keywords: OBE education concept; applied; undergraduate colleges and universities; robotics engineering major; practice teaching

Introduction

With the continuous progress of science and technology, robotics has become one of the popular fields in the current society. Applied undergraduate colleges and universities bear an increasingly important responsibility in cultivating robotics engineering professionals, however, there are some problems in the practice link under the traditional teaching mode, which limit the development of students' own abilities. Therefore, it is of great significance to explore how to promote the practical teaching reform of robotics engineering majors in applied undergraduate colleges and universities from multiple aspects based on the OBE education concept to improve students' practical ability and comprehensive quality and promote the development of robotics.

1. Definition and Principles of OBE Education Philosophy

OBE education concept (Outcome-Based Education, Goal-Based Education) is a student-centered education model, which aims to take the students' learning outcomes as the evaluation standard of the teaching process and focuses on cultivating the students' abilities and practical application skills (Zhang & Ma, 2021).The principles of OBE education concept are: emphasize the students' learning outcomes, i.e., the design and evaluation of the education process should be be based on the results actually achieved by students, rather than focusing only on the curriculum and teaching methods (Huang & Li, 2022); student-centered, i.e., educational objectives, teaching content and teaching methods should be designed according to the needs and actual situation of students, and focus on exploring the potential and strengths of each student; guiding students to learn independently, i.e., teachers should respect the learning interests and personalities of students, and

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focus on guiding them to develop their initiative and autonomy, and cultivate students' learning abilities (Fu et al., 2020). Teachers should respect students' learning interests and personalities, focus on guiding students to develop their initiative and autonomy, and cultivate students' learning ability and self-management ability. students to be able to adapt to the social demand and development trend.

2. The Current Situation of Practical Teaching of Robotics Engineering in Applied Undergraduate Colleges and Universities Based on OBE Education Philosophy

2.1 Disconnect between teaching content and practical application

Under the background of OBE education concept, there exists the problem of disconnection between teaching content and practical application in the practical teaching of robotics engineering in applied undergraduate colleges. The main manifestation of this problem is that there is a large gap between students' theoretical knowledge and practical application. The traditional teaching mode focuses on theoretical learning, and the cultivation of practical application is relatively small. In robotics engineering, students need to master a variety of theoretical knowledge, such as circuit principles, automatic control, etc., but only stay in the theoretical level of learning, can not really help students to master the practical skills and the ability to solve practical problems. When they step into the practice session, they often do not know how to apply what they have learned to the real world. At the same time, the traditional teaching mode lacks a teaching design that combines with actual scenarios, which leads to the fact that students cannot really understand and feel the role and significance of robotics in practical applications (Wu et al., 2023). In this way, it is difficult for students to combine theoretical knowledge with practical applications, and they lack the ability to solve practical problems. In addition, the traditional teaching mode lacks the introduction of actual cases and the penetration of practical sessions. In the robotics engineering program, students need to enhance their practical ability through actual case studies and comprehensive practical tasks. However, in traditional teaching, it often focuses only on the teaching of basic knowledge and the explanation of the theoretical level, ignoring the importance of the practical aspects. In this way, students' practical application ability is not fully developed.

2.2 Lack of teamwork ability training

Robotics engineering majors need students to have strong teamwork skills so that they can communicate and collaborate with colleagues, customers and suppliers in their future work. However, under the traditional education model, students often lack practical experience in teamwork, which leads to their lack of confidence when facing teamwork in the actual work, and makes it difficult for them to collaborate with others effectively. In school, students usually have to complete tasks such as coursework and academic research independently, and seldom have the opportunity to work together in teams to complete tasks. This leads to students' misunderstanding and awareness of teamwork, making it difficult for them to truly master the skills of effective communication and collaboration among teams. Meanwhile, the practical teaching of robotics engineering requires students to master a large number of practical skills and the ability to solve practical problems (Wu et al., 2023). However, under the traditional education model, students tend to complete tasks independently and lack the practical experience and cultivation of teamwork. In addition, under the traditional education model, due to the lack of practical training in socialization and communication, students have limited sociability and expressive skills, which are precisely the basic qualities necessary for teamwork.

2.3 Lack of objective and comprehensive assessment methods

Under the concept of OBE education, the assessment methods in the practical teaching of robotics engineering in applied undergraduate colleges and universities often suffer from the problem of lack of objectivity and

comprehensiveness. On the one hand, the traditional assessment method tends to test students' knowledge mastery and neglects their ability in practical operation and teamwork, resulting in students paying too much attention to the learning of theoretical knowledge and neglecting the cultivation of practical operation ability. On the other hand, traditional assessment methods often lack the assessment of students' teamwork ability. In robotics engineering, teamwork ability is a very important ability. However, traditional assessment methods tend to focus only on individual performance and neglect students' collaboration and contribution in the team. As a result, it is difficult for students to truly exercise and demonstrate their teamwork abilities and to obtain effective feedback on their teamwork abilities from assessments. In addition, traditional assessment methods often lack the assessment of students' comprehensive quality and innovation ability. The robotics engineering program requires students to have strong innovative thinking and problem-solving ability. However, in traditional assessment methods, they often focus only on students' understanding and memorization of knowledge points, neglecting the assessment of their innovative thinking and problem-solving abilities. In this way, students may only pursue test scores and neglect the importance of cultivating innovative ability and comprehensive quality.

3. Practical Teaching Strategies for Robotics Engineering Specialization in Applied Undergraduate Colleges and Universities Based on OBE Education Concepts

3.1 Project-driven learning

Project-driven learning is an important strategy in the practical teaching of robotics engineering majors in applied undergraduate colleges based on the OBE teaching concept. This strategy focuses on the project as the core, through the students' participation in the design, development and implementation of actual projects, the theoretical knowledge is applied in practice, and the students' ability to solve practical problems is cultivated (Guo et al., 2019). In project-driven learning, the selection of projects is crucial. The project should be authentic and practical, able to stimulate students' interest and motivation, and match the course objectives. For example, a practical application scenario can be chosen - making a mobile robot capable of autonomous obstacle avoidance, etc. Project-driven learning requires students to be divided into teams, and each team will be responsible for one project. When forming project teams, teachers should group students reasonably according to their interests, expertise and personality traits, in order to stimulate students' enthusiasm for participation and take advantage of teamwork (Zhang et al., 2020). Each team member plays different roles in the project, such as project manager, design engineer, programmer, etc., and completes the project together through cooperation. At the beginning of the project, students need to plan the project. This includes defining the project objectives, developing a detailed work plan and schedule, and determining resource requirements. Teachers can provide guidance and advice to help students develop reasonable project plans. For example, by discussing and communicating with students, they will be guided to determine the technical requirements, functional realization, schedule and quality standards of the project. In the process of project implementation, students will carry out several stages of work, such as requirements analysis, system design, hardware construction, software programming, testing and debugging. Teachers should provide students with necessary resources and guidance, such as experimental equipment, software tools, related materials, etc., so that students can effectively carry out project practice. At the same time, teachers should also carry out regular discussions and guidance with students, answer the problems encountered by students, and provide necessary technical support.

3.2 Focus on multiple assessments

In the practical teaching of robotics engineering in applied undergraduate colleges and universities, multivariate assessment is one of the important

teaching strategies based on the concept of OBE education, the core idea of which is to formulate different forms of assessment methods for each learning objective, so as to ensure that the learning outcomes and ability development of students can be comprehensively and objectively evaluated. In the practical teaching of robotics engineering, students need to master a series of professional knowledge and skills. Therefore, teachers should clarify the learning objectives and break them down into specific competency requirements. For example, the learning objectives may include robot system design ability, programming ability, innovative design ability and so on. This provides a clear basis for subsequent assessment. At the same time, different learning objectives require different assessment methods. For example, for robot system design ability, students' design solutions and problem solving ability can be assessed by carrying out projects; for programming ability, it can be assessed by programming assignments or practical application tasks; for innovative design ability, it can be assessed by the innovative ideas put forward by students and the effect of practical application. This diversified assessment method can comprehensively examine students' abilities from different perspectives (Ji et al., 2022). In addition, the assessment process should be as objective as possible to avoid the influence of subjectivity and bias. To ensure the fairness of the assessment, teachers may consider adopting standardized rating scales or assessment indicators in order to provide an objective and comparable assessment of students' learning outcomes. In addition, teachers may consider introducing peer review or group mutual assessment so that students can evaluate each other and help them identify their strengths and directions for improvement. The assessment results can also provide a basis for teachers to improve teaching methods and project design, and continuously optimize the effectiveness of practical teaching.

3.3 Practice-oriented

Practice-oriented is a practice-oriented teaching method, which emphasizes that students should learn and apply knowledge through practice and have the ability to solve practical problems. In the education of robotics engineering majors in applied undergraduate colleges and universities based on OBE education theory, practice-oriented teaching is a proven teaching method, which can help students better integrate into the professional field and train them to become professionals with practical abilities. In particular, a complete robotics engineering education should include both the learning of professional theoretical knowledge and the practical exploration of actual engineering applications. Therefore, applied undergraduate colleges and universities should strengthen the proportion of engineering practice teaching in the curriculum. For example, practical courses such as robot system design, robot programming, robot control and robot application can be offered to help students gain an in-depth understanding of the workflow and technical fields of the robot industry. At the same time, all aspects of robotics engineering education, such as classrooms, laboratories, curriculum design, project implementation and practice opportunities, should be brought into full play to build a good practical teaching environment. For example, advanced robot hardware equipment and professional software platforms are provided to provide students with practical opportunities such as actual projects and case studies, and simulation of robot application scenarios (Shi, 2021). In addition, in the education of robotics engineering, which is highly practical, flexible and diverse teaching methods should be used for teaching. For example, different forms of practical teaching can be carried out for students of different levels or needs. Classroom lectures, case studies, on-site experiments, engineering projects, competition practice, interdisciplinary research and other methods can be used to complete the education and training of students' knowledge and ability. Of course, teachers also need to keep abreast of the technological development trends, hot issues and application scenarios in the field of robotics, update the teaching content and methods, as well as seize the opportunity to help students continuously improve

their professional quality and practical ability by utilizing the talent needs of cooperative enterprises in the robotics industry and various practical opportunities inside and outside the curriculum.

Summarize

To summarize, the traditional teaching mode in the field of robotics technology has problems such as the disconnection between teaching content and practical application, the lack of teamwork ability cultivation and the lack of objective and comprehensive assessment methods. In this regard, this paper proposes three key strategies, namely, project-driven learning, focusing on multiple assessments, and practice-oriented. The implementation of these strategies will help to improve students' practical ability and teamwork ability, as well as enhance their comprehensive quality in the field of robotics engineering, which will in turn cultivate robotics engineering professionals with more application ability and innovation ability and contribute to the development of robotics technology.

Conflict of Interest

The author declares that he has no conflicts of interest to this work.

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