

Exploration and Practice of Teaching Reform of Robotics Engineering Specialty Based on Project-based Teaching

Yunhe Zou¹, Jianxin Wu^{1*}, Yifang Wang², Xiaodong Guo¹, Lulu Liu³

1. School of Mechanical Engineering, Inner Mongolia University of Technology, Hohhot 010051, China

2. School of Economics and Management, Inner Mongolia University of Technology, Hohhot 010051, China

3. Center for Teaching Advancement and Faculty Development, Inner Mongolia University of Technology, Hohhot 010051, China

Abstract: With the rapid development of science and technology, the new research direction of robotics is also getting more and more attention. The teaching reform of robotics engineering based on project-based teaching should break the traditional teaching mode. Through the introduction of practical projects, students can not only master the theoretical knowledge they have learned, but also develop a strong application ability in the process of internship. This reform of teaching is not only conducive to the cultivation of students' comprehensive ability, but also adapts to the needs of society for robotics talents. Through project-based teaching, students can have a deeper understanding of the core principles and application situations of robotics and have a deeper knowledge of their future work.

Keywords: Project-based teaching; Robotics engineering; Teaching reform strategies

1. Introduction

With the rapid development of science and technology, robots have gradually penetrated into all fields of society and become an important part of today's industrial automation. China's robotics program is an important base for training high-quality professionals, and its teaching level is of great significance to the development of China's robotics industry. However, the traditional teaching mode of robotics engineering is mostly based on theoretical knowledge, resulting in a lack of students' ability to solve practical problems. Therefore, it is very necessary to reform the teaching of robotics professional courses.

2. Overview of project-based teaching

2.1 Definition of project-based instruction

Project teaching is a kind of education method that takes actual engineering as the core, and under the guidance of teachers, allows students to take the initiative to participate in the whole process of designing, implementing, and finally completing the project, so as to obtain knowledge and technology. Project-based teaching focuses on students' subjective initiative, practicality, and taking knowledge from passive reception to active research and practice. The main content of project-based teaching method is to combine theoretical knowledge and practical operation, so that students can further master the theoretical knowledge they have learned in practical work and enhance their practical application ability.

2.2 Characteristics of project-based instruction

One is completeness. Project teaching requires students to synthesize and apply the knowledge and skills they have learned to solve practical problems or complete a project. This integrated teaching method is conducive to the development of students' comprehensive ability and their ability to think across disciplines. For example, students majoring in robotics must synthesize knowledge from different disciplines, such as mechanics, electronics, and computer science, in order to design a robot. Such a program requires both a solid theoretical foundation and creative thinking and problem-solving abilities. Second, practicality. Project teaching emphasizes that students learn while doing experiments to test what they have learned. The practical teaching method promotes the cultivation of students' hands-on ability.

3. Problems in the teaching of robotics engineering program

3.1 Lagging behind in book knowledge and a single teaching mode

With the rapid development of intelligent manufacturing technology, China's demand for robotics personnel is also growing. In order to

adapt to the needs of the development of China's construction industry, our colleges and universities have opened the corresponding specialties. However, at present, China's colleges and universities in the professional structure, teaching methods and other aspects there are still many deficiencies, so that there is a large gap between the talents trained and the market needs. In particular, the robotics textbooks used in colleges and universities are now updated once a year, so the market for this specialty is developing rapidly. If the textbooks do not keep up, the knowledge learned by students will be eliminated by the times. In addition, due to the traditional teaching methods, students' initiative and creativity are not fully utilized.

3.2 Disconnection between theory and practice, unsatisfactory practice results

From the current status quo, many universities and colleges of robotics in the classroom settings are theory-based, the lack of corresponding practical guidance, which makes the students can not apply the knowledge learned in a timely manner to the actual situation, which seriously affects the effectiveness of teaching. However, in practice, because the theoretical teaching is still at the forefront of research, the curriculum that corresponds to it can not be well matched, resulting in insufficient feedback from students. In addition, the practice of robotics teaching has its own specificity, which needs to be built on two levels: professional basic skills training and vocational skills integration training. If only one aspect of leadership is emphasized, it will inevitably lead to the "distortion" of students' inquiry-based learning, which in turn affects the overall effect of teaching.

3.3 Some teachers lack good engineering practice experience

At present, the research in the field of robotics in China is still in the primary stage, and one of the most prominent problems is the weakness of the teacher team. At present, teachers in colleges and universities generally have high professional quality and high teaching ability. However, on the whole, the teachers' practical ability is poor, which makes it difficult to provide effective internship guidance to students, thus resulting in the phenomenon of disconnection between theory and practice. In addition, in the process of research, teachers' main efforts are focused on the research of the subject, and the transformation of the research results is neglected. Many excellent robotics research programs are just a kind of teaching demonstration rather than practical application. At the same time, it will also affect students' understanding of the teaching profession, which will have a negative impact on their future development.

4. Teaching Reform Strategies for Robotics Engineering Majors Based on Project-based Teaching

4.1 Focus on process-oriented training

The research is based on the development of students' creativity, and the project proposal is a test of the stage of learning carried out by the students. In the project proposal, the organization of a systematic and standardized teaching content for students is proposed. Improvement of scientific, technical and creative abilities of students, strengthening of supervision and assessment of students is an important guarantee of improvement of teaching quality. Under the guidance of the "3 1s", students are instructed to write papers and organize what they have learned into rigorous scientific research materials and academic reports. Weekly group meetings can help teachers understand the learning status of the students and make adjustments according to the learning status of the students, thus forming a good team atmosphere.

4.2 Focus on the integration of specialized knowledge and problem solving

Project-based teaching has a major advantage over traditional classroom teaching, providing students with a new way of learning from the perspective of applied technology. The topic-based learning model allows students to go beyond the material provided and interact with other robotics-related knowledge in a similar manner, thus developing their own specialized knowledge storage system. The students are provided with the required learning platform under the overall guidance of research and development, while ensuring the safety of the experimental environment. In such an environment, students stay in the lab during their free time. With a combination of interest and effort, the course progresses and teaches robotics-related techniques, allowing students to learn the theory in a more relaxed state of mind while attending classes.

4.3 Focusing on the construction of science and innovation environment and the inspiration of innovative thinking

In order to create a favorable training environment, the team has built a technological innovation environment oriented to robotics research. Relying on the robotics research and development center it owns, it is committed to high-level applications in all areas to meet the needs of scientific and technological innovation. In the initial phase, the team focused on providing students with various offline tours, physical learning, and a variety of free exploration programs such as background research. Through online instruction in the classroom and frequent interactions with students outside of the classroom, senior faculty members have been successful in stirring students' interest in learning by teaching robotics while focusing on researching students' careers and guiding their thinking about robotics issues.

4.4 Establish a practical teaching system that combines the curriculum system with the industry

In project-based teaching, the focus of the robotics course should be industry-oriented, focusing on cultivating students' practical ability

to quickly adapt to market needs after graduation and promoting the rapid development of the industry. Based on this, teachers should organically integrate the experiments and practical training of robotics-related courses in the implementation of practical courses, so that students can freely convert between theory and practical operation to enhance their practical innovation ability. In particular, a more comprehensive and diversified curriculum system is constructed from the two levels of experimental training and robotics competitions to ensure that students gain more practical experience in robotics and automated production systems and maximize their initiative. In addition, in the experimental class, it is also necessary to actively innovate the traditional robot control experiments and transform them into application experiments to better stimulate students' innovative thinking and promote the teaching of robotics.

4.5 Establishing a diversified assessment method for robotics engineering majors

In general, robotics teaching is a discipline that pays more attention to practicality, while in fact, it contains a large amount of theoretical knowledge. Under the new situation, the traditional education method can no longer meet the needs of human development. For this reason, the concept of "new engineering" should be used as a guide to build a diversified comprehensive evaluation system, which is evaluated at four levels: teaching evaluation and practical evaluation, curriculum division and formative evaluation, in order to cultivate more diversified talents for China's robotics industry. In order to better recognize the strengths and weaknesses of students, so as to lay a good foundation for the future development of targeted courses and comprehensive evaluation of students' academic performance and ability development. In the traditional evaluation methods, new evaluation methods such as group discussion and practical operation should be added in order to better recognize the differences of students and promote their innovativeness.

5. Conclusion

In summary, in order to improve the quality of robot teaching and cultivate high-quality talents, it should be innovated from the perspective of teaching reform. In the long run, the education mode of robotics engineering should be aimed at improving the scientific research and development ability of students, as well as improving the overall quality of students. Project-based teaching mode is a kind of teaching mode adapted to the requirements of the new era. This paper has done some exploration and practice in this area and received certain results. From the perspective of the future development trend of robotics engineering education, in order to meet the needs of society for professionals, a larger and longer-term exploration and practice is needed.

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