

Exploration and Practice of the Education and Teaching Mode of “Internet + Education” Mechanical Major, “New Teaching and New Paradigm”

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Abstract:

With the rapid development of information technology, the Internet has penetrated into all fields of social life, and education is no exception. As an important part of engineering education in China, mechanical majors are faced with the challenge of the mismatch between the traditional teaching mode and the development needs of modern society. In order to cultivate mechanical professionals who meet the requirements of the new era, it is urgent to explore the new teaching paradigm under the background of “Internet + education”. This paper discusses how to construct the new teaching and new paradigm of educational teaching mode under the background of the Internet era, improve students’ learning effect and practical ability, and provides a useful reference for cultivating high-quality educational machinery professionals to meet the needs of The Times.

Keywords:

Internet + Education, Mechanical Major, New Teaching, New Paradigm, Construction of Education and Teaching Mode

1. Introduction

The traditional teaching mode is difficult to meet the students’ personalized learning needs, the teaching resources are scattered, it is difficult to achieve sharing, the teaching means are single, the lack of interactivity, and the practical teaching link is disconnected from the actual engineering application. This study aims to analyze the current situation of mechanical professional education and teaching, and explore how to use the Internet technology to optimize the teaching process, improve the teaching quality, and cultivate mechanical professionals with innovative spirit and practical ability.

2. The Construction Significance of “Internet + Education” “Mechanical Major, New Teaching and New Paradigm”

With the rapid development of information technology, the Internet has penetrated into all fields of society, and education is no exception. In mechanical majors, constructing the new teaching mode of “Internet + education” has important practical significance and far-reaching historical influence.

2.1. Improve the teaching quality and cultivate innovative talents

The Internet provides rich teaching resources for mechanical majors, such as online courses, teaching videos, experimental guidance, etc., which help teachers to better carry out teaching activities and improve the teaching quality. Students can acquire more knowledge through the Internet, broaden their horizons, and improve their independent learning ability. At the same time, teachers can also use the Internet to carry out cross-school, cross-regional exchanges and cooperation, and improve the teaching level [1]. The new teaching mode encourages students to actively explore and innovate in practice, which helps to cultivate students' innovative spirit and practical ability, and provides a steady stream of talent support for the development of China's manufacturing industry.

2.2. Promote education equity and narrow the gap between urban and rural areas

The Internet has broken the geographical restrictions, enabling students in remote areas to enjoy high-quality educational resources, helping to narrow the education gap between urban and rural areas. The new teaching model provides equal learning opportunities for students from different backgrounds and abilities, which contributes to the realization of educational equity.

2.3. We will promote education reform and improve the quality of education

The new teaching mode is student-centered and pays attention to cultivating students' ability of independent learning, cooperative learning and inquiry learning, which is helpful to promote educational reform. The new teaching mode emphasizes practicality and innovation, which helps to improve students' comprehensive quality and improve the quality of education.

2.4. Promote industrial upgrading and serve the national strategy

The new teaching mode is helpful to cultivate high-quality talents to meet the needs of the development of the manufacturing industry and provide talent guarantee for the transformation and upgrading of China's manufacturing industry. The new teaching mode is helpful to improve the innovation ability of China's manufacturing industry, promote industrial upgrading, and achieve high-quality development.

3. Construction of New Teaching and New Paradigm of Mechanical Major Teaching Mode for “Internet + Education”

3.1. Resetting of teaching objectives 1

3.1.1. Determine new teaching objectives according to the needs of the industry and student development

Deep understanding of the technology development trend of the machinery industry, such as intelligent manufacturing, robotics, 3D printing, etc., to ensure that the teaching objectives keep pace with the forefront of the industry. Through enterprise research, industry reports and other ways, to understand the specific needs of the machinery industry for talents, including professional skills, comprehensive training of students' independent learning ability, so that they have the ability to adapt to the future changes of the industry [2]. To ensure that students master the basic knowledge and cutting-edge technology of the mechanical major, and have the ability to solve practical problems. Through the above steps, we will build a new teaching mode and new paradigm of mechanical majors in line with the background of "Internet + education", and lay a solid foundation for cultivating excellent talents to meet the needs of the future industry.

3.1.2. Emphasize the comprehensive cultivation of knowledge, skills and accomplishment

Under the background of "Internet + education", for the construction of new teaching and new paradigm of education and teaching mode of mechanical majors, the reorganization of teaching objectives should emphasize the comprehensive cultivation of knowledge, skills and accomplishment. In the Internet environment, teachers should make full use of network resources, broaden students' knowledge, improve students' comprehensive quality, and pay attention to cultivate students' practical operation ability and innovative thinking, pay attention to cultivate students' moral quality, humanistic quality and social responsibility.

3.2. Optimization and integration of teaching content

3.2.1. Introduce Internet resources to enrich the teaching content

Combine traditional teaching materials with Internet resources to form an integrated online and offline teaching material system. Teachers can select high-quality teaching resources, such as videos, cases and experimental data, from the network platforms, databases and other channels, so as to enrich the teaching content and improve the teaching quality. Teachers are encouraged to develop or introduce open online courses from well-known universities at home and abroad to provide students with more diversified learning choices. Students can independently choose the learning content independently according to their own interests and needs to improve the learning effect. Using the Internet platform, to provide students with rich practical teaching resources, such as virtual simulation experiment, online experiment report, remote laboratory and other [3]. Students can conduct experiments in a virtual environment to improve their practical ability. Establish a platform for sharing education and teaching resources for mechanical majors to realize the sharing of high-quality educational resources. Teachers can upload their own teaching resources for other teachers and students to use.

3.2.2. Integrate theoretical teaching and practical teaching content to realize integrated teaching

In terms of curriculum setting, theoretical teaching and practical teaching content are organically integrated, so that students can master practical operation skills while learning theoretical knowledge. Break the boundaries of traditional disciplines, and

combine mechanical majors with other related disciplines such as computer, automation, material science, etc., to broaden students' knowledge.

3.3. Innovation in teaching methods 1

3.3.1. Use the online teaching platform to carry out mixed teaching

Build an online teaching platform with perfect functions and convenient operation, as shown in Figure 1, to provide a convenient teaching environment for teachers and students. The specific functions of the platform are shown in Table 1. According to the characteristics of the course, the combined online and offline teaching programs are formulated to realize the effective connection between theoretical teaching and practical teaching. Teachers publish teaching resources, such as courseware, videos, exercises, etc., for students to study independently. Students study through the online platform to complete assignments, discussions, tests and other tasks. Teachers answer students' questions online and provide personalized tutoring [4]. In the next teaching link, teachers organize classroom discussion, experiments, practical training and other teaching activities to guide students to deeply understand the theoretical knowledge. Under the guidance of teachers, students should complete experiments, practical training and other practical links to improve their practical ability. Teachers will evaluate and give feedback according to the students' performance. In terms of teaching evaluation and feedback, teachers collect students' learning data through online platforms, analyze teaching effects, and adjust teaching strategies in time. Students evaluate the teaching process and the teaching effect to provide teachers with the direction of improvement. Through mixed teaching, the organic combination of theoretical teaching and practical teaching is realized, and the teaching effect is improved. Stimulate students' interest in learning, cultivate students' independent learning ability, innovation ability and practical ability. We will use online teaching platforms to enable more students to enjoy high-quality educational resources and narrow the educational gap between urban and rural areas and between regions.

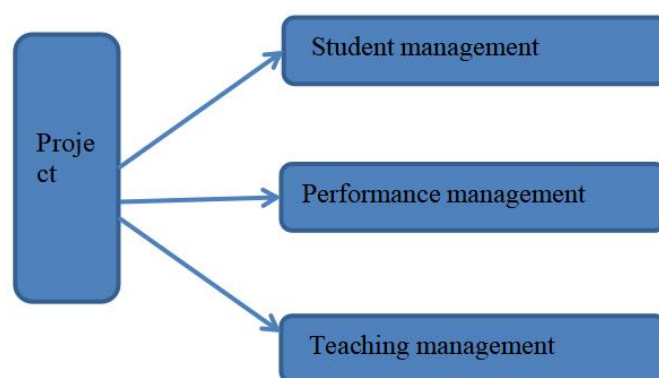


Figure 1. Mixed teaching function of the online platform.

Table 1. Specific content of the platform.

Project	Content
Student management	Learning level, individual differences
Performance management	Test results, learning efficiency, and homework statistics
Teaching management	Classroom design, classroom monitoring, and classroom summary

3.3.2. Use the virtual simulation technology to enhance the practical teaching effect

Virtual simulation technology is a technology of simulates the real world through computer, which is highly authenticity and interaction. In the teaching of mechanical majors, virtual simulation technology can provide students with rich practice scenarios and improve the practice teaching effect. Through the virtual experiment platform, the students can carry out the experimental operation in the virtual environment to improve the experimental skills. Combined with virtual simulation technology, we will develop courses with practical application background to improve students' ability to solve practical problems. Hold virtual simulation competition to stimulate students' interest in learning, cultivate students' innovative spirit and teamwork ability [5]. Virtual simulation technology can provide students with rich practice scenarios and improve the practice teaching effect. Virtual simulation technology can reduce the investment of experimental equipment and experimental materials, and reduce the cost of practical teaching. Virtual simulation technology can realize resource sharing and improve the utilization rate of teaching resources.

3.3.3. Implement the project-driven teaching method to cultivate students' innovation ability and the ability to solve practical problems

Combined with the characteristics of mechanical majors, the projects with practical application value, innovation and challenge are selected as the teaching carrier. The project is decomposed into several sub-tasks, and the goals, requirements, and time nodes of each sub-task are clearly defined. According to the students' interests and specialties, the students are divided into several groups, and each group is responsible for completing a sub-task. Under the guidance of teachers, each group makes use of Internet resources to consult information, analyze problems, design solutions, and gradually complete the sub-tasks. Each team presented the project results to the whole class, including the project background, implementation process, problems encountered and solutions, etc. Teachers evaluate the project results, including innovation, practicality, teamwork and other aspects. Project-driven teaching method emphasizes students' independent inquiry and innovative practice, which helps to cultivate students' innovative thinking. Through practical project operation, students can combine theoretical knowledge with practical application to improve their ability to solve practical problems. Project-driven teaching method requires students to cooperate in groups to complete tasks together, which helps to cultivate students' teamwork ability. Project-driven teaching method takes the actual project as the carrier to stimulate students' interest in learning and improve their learning enthusiasm. Project-driven teaching method requires teachers to have strong project planning and guidance ability, which is helpful to improve teachers' teaching level.

3.4. Establishment of teaching evaluation system 1

3.4.1. Construct diversified teaching evaluation indicators

Clarify the evaluation index system, evaluate the scientific nature, frontier and practicability of the teaching content, and whether it conforms to the training objectives of mechanical professionals. To evaluate the innovation, interactivity and practicality of teaching methods, and whether they can stimulate students' interest and enthusiasm in learning. To evaluate the richness, diversity and sharing of teaching resources, and whether they can meet students' personalized learning needs. Evaluate students' learning results, including knowledge mastery degree, practical ability, innovation ability, etc. To evaluate teachers' professional level, teaching ability, scientific research ability, teacher ethics, etc. The teaching content includes

curriculum setting, teaching material selection, teaching syllabus, teaching schedule and so on. Teaching methods include classroom teaching, case analysis, experimental and practical training, project teaching, flipped classroom, etc. Teaching resources include online courses, teaching courseware, experimental instructions, practice cases and so on. The teaching effects include students' examination results, practical operation ability, innovation ability, employment competitiveness and so on. Teachers' quality includes teachers' academic qualifications, professional titles, teaching experience, scientific research achievements, and teacher ethics and so on.

3.4.2. Use the combination of process evaluation and final evaluation

In the course of course learning, we pay attention to the evaluation of students' learning attitude, learning habits, practical ability and other aspects, and pay attention to students' final examination results. The classroom performance, experimental report, project results and other evaluation methods are adopted to comprehensively evaluate the students' comprehensive quality. Pay attention to students' performance in their speeches, questions and discussions in class, and evaluate their learning attitude and participation. Through experiments, projects and other practical activities, to evaluate the students' practical ability and innovation ability. With the final examination as the main evaluation method, the students' mastery of the course knowledge is comprehensively evaluated. Through the project results completed by the students, we will evaluate their ability to comprehensively use knowledge and solve practical problems.

3.4.3. Introduce students' self-evaluation and mutual evaluation mechanism

Through learning, students can self-recognize their own knowledge, skills, attitudes and other aspects, and make clear their own advantages and deficiencies. In the process of learning, the students should reflect on the mastery of the knowledge and skills they have learned, find out the problems, and provide the improvement direction for the follow-up learning. Through self-evaluation, students can stimulate their learning motivation and improve their learning effect. Students learn from each other and help each other to improve together. In the process of mutual evaluation, students can learn from others and make up for their own shortcomings. After mutual evaluation, students will give timely feedback to help the evaluators understand their own shortcomings and provide guidance for follow-up learning. Through self-evaluation and mutual evaluation, students can better understand themselves and improve their ability of independent learning. In the process of mutual evaluation, students learn to listen, respect others, and cultivate team spirit. Through evaluation and feedback, teachers can adjust teaching strategies in time and improve teaching quality. In the process of self-evaluation and mutual evaluation, students can develop in an all-round way and improve their comprehensive quality.

3.4.4. Evaluation steps and result analysis

Through statistical data, questionnaire survey, experimental test and other ways, the teaching evaluation index is quantitatively analyzed. Qualitative analysis of teaching evaluation indicators is conducted through expert review, peer review and student feedback. Combine the quantitative evaluation and the qualitative evaluation to make a comprehensive, objective and fair evaluation of the teaching evaluation index. According to the evaluation results, the paper analyzes whether the teaching content conforms to the professional training objectives, whether it meets the needs of

students, and whether there are some problems such as incomplete knowledge system and outdated content. Analyze the applicability and innovation of teaching methods, whether it can stimulate students' interest in learning and improve the learning effect. According to the evaluation results, the paper analyzes whether the allocation of teaching resources is reasonable and whether it meets the teaching needs. According to the evaluation results, teachers should adjust the teaching content and teaching methods, optimize the teaching process, and improve the teaching quality. According to the evaluation results, the curriculum system is optimized, the curriculum setting is adjusted, and the curriculum quality is improved. According to the evaluation results, the teaching resources are integrated to improve the utilization rate of the teaching resources. According to the evaluation results, the teaching evaluation system is constantly improved to ensure the objectivity and impartiality of the evaluation results. According to the evaluation results, strengthen the construction of teaching team, improve the teaching level and comprehensive quality of teachers. According to the evaluation results, we should pay attention to the individual differences of students, implement differentiated teaching, and improve the students' comprehensive quality. Under the background of "Internet + education", the application of evaluation results is an important link to ensure the teaching effect and the teaching quality of the new teaching mode according to the new teaching mode of mechanical majors. Through the scientific and reasonable application of evaluation results, the teaching process is continuously optimized, and the teaching quality is improved to provide a strong guarantee for the training of high-quality mechanical professionals.

4. Conclusions

"Internet + education" provides new development opportunities for the education and teaching of mechanical majors, and helps to improve the teaching quality and cultivate innovative talents. The new teaching paradigm should pay attention to the integration of teaching resources, realize the resource sharing, and improve the teaching efficiency. The innovation of teaching mode should pay attention to the students' personalized learning needs and improve the teaching interaction. The reform of teaching evaluation should pay attention to the process evaluation and the cultivation of students' comprehensive quality. The implementation of the new teaching paradigm needs to strengthen the construction of teachers and improve the teachers' information teaching ability. This study provides a useful reference for the teaching reform of mechanical majors, and helps to promote the education and teaching of mechanical majors in China to a higher level.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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References

- [1] Xu, X.S. Research on the teaching reform of technical education and machinery manufacturing major under the background of "Internet +". *Paper equipment and materials*, 2022, 51(11), 236-238.

- [2] Zhu, L.D.; Gong, Y.D.; Yu, T.B Analysis on the teaching reform of mechanical majors based on “Internet +” and Big Data. *Modern Education Equipment in China*, 2022, 11, 14-16.
- [3] Hu, L. Application of Information Technology in Secondary Vocational Machinery Teaching under the perspective of “Internet + Education”. *Career*, 2021, 23, 91-92.
- [4] Zhang, L. Research on the reform and innovation of core courses in the era of “Internet +” education. *Electronic components and Information Technology*, 2021, 5(09), 134-135.
- [5] Pan, W.D. Reform of teaching mode of mechanical major under the background of “Internet +” —— Take the School of Mechanical and Electrical Engineering of Jinggangshan University as an example. *Industrial Technology and Vocational Education*, 2021, 19 (03), 44-46.



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