

Research on the Practical Training Mode of Mechanical and Electrical Professionals Based on "Three-Level Progressive and Four in One"

Xiaobo Zhang^{1,*}, Shungen Xiao^{2,*}, Yi Peng¹, Mengmeng Song²

¹School of automotive mechanics and electronics, Jiangxi Environmental Engineering Vocational College, Ganzhou 341000, People's Republic of China

²College of information, Mechanical and Electrical Engineering, Ningde Normal University, Ningde 352100, People's Republic of China

*Correspondence: Xiaobo Zhang; Shungen Xiao

Abstract

Aiming at the main problems in the practical teaching of Electromechanical Specialty, Explore and practice the "three-level progressive, four in one" practical training mode for electromechanical professionals;A practical course of Electromechanical Specialty with "foundation strengthening, project driving and engineering practice" as the core has been established.It has integrated a three-level progressive practical teaching platform characterized by "engineering foundation, engineering specialty and engineering integration",Highlight practical applicability and improve practical teaching.It has stimulated students' interest in learning, enhanced students' practical ability, application ability and innovation ability, and achieved good teaching results.

Keywords

School enterprise collaboration; Special project; Criterion for curriculum.

1. Introduction

Electromechanical Specialty in higher vocational education is a comprehensive subject with strong practicality, it provide a large number of skilled talents for the manufacturing industry.With the promulgation of made in China 2025, China's future industrial model will enter a new stage of intelligent manufacturing, Intelligent manufacturing industry also puts forward new requirements for technical and skilled talents.Therefore, how to carry out the practical teaching reform of Electromechanical Specialty in higher vocational colleges is worthy of our exploration and practice?

Currently, The main problems in the practical teaching of Electromechanical Specialty are: The practice teaching plan, curriculum system and practice teaching link settings are influenced by tradition and are not very suitable for the actual work; The connection between the practical teaching content and post skills is not enough, and the practical teaching effect is not good [1]; The training and teaching platforms inside and outside the school are scattered and unsystematic,many confirmatory demonstration training platforms, insufficient engineering comprehensive training platform, the practical teaching environment can not meet the requirements of workplace training,It is difficult to support the cultivation of engineering practice and innovation ability of Higher Vocational Students.

Under this background, we put forward the practical teaching path of "three-level progressive and four in one",The so-called "three-level progressive and four element integration",It refers to the professional skills and professional quality objectives and requirements of enterprises for electromechanical talents according to the students' cognition and skill growth law,With

engineering practice as the core, create a three-level progressive engineering training platform of "Engineering Foundation", "engineering special" and "engineering integration"; At the same time, it is oriented by ability training, Restructure practical teaching projects, It is divided into special training, comprehensive training, competition training and innovation training. The four kinds of training are implemented and conducted layer by layer. through special training master basic professional skills ; Through comprehensive training, strengthen the cultivation of students' professional core competence and professional core competence; Through competition training, strengthen students' comprehensive application ability of professional knowledge and skills; Through innovation training, improve students' innovation and entrepreneurship ability and comprehensive quality. Thus, the bad problems in the practical teaching of mechanical and electrical specialty are solved.

2. The Implementation Path of The Practical Training Mode of "Three-Level Progressive and Four In One"

2.1. Taking Ability Training as The Guide, Constructing A New Ecology of "Four in one" Practical Teaching

The center of practical teaching is students[2], Sort out, summarize and summarize the problems of students in the whole career of Higher Vocational Education, the research group focuses on the core of "project driven and skill strengthening", Exploring the new ecology of "four in one" classroom teaching, It has solved the problems that the practical teaching plan, curriculum system and practical teaching links in the process of practical teaching do not adapt to the actual work, the connection between the practical teaching content and post skills is not enough, the students' learning enthusiasm and initiative are not enough, and the practical teaching effect is not good. Focusing on the main line of "skill training and quality improvement", we have achieved the goal of cultivating talents with craftsman spirit of "dedication, lean, focus and innovation". Adhering to the principle of "task orientation and progressive ability", focusing on classroom reform, the practice teaching curriculum standard characterized by "small course projects, large semester projects and general graduation projects" has been established, and the higher vocational classroom revolution of "ability-based, role transformation and situation reconstruction" has been realized.

(1) Take "skill training and quality improvement" as the main line, strengthen school enterprise collaboration, and achieve the training goal of craftsman talents characterized by "dedication, lean, focus and innovation".

The research group firmly grasped the main line of "skill training and quality improvement" and combined vocational skill identification, teaching and production training, three-level competition training, fixed position practice and practical teaching. At the same time, the research group relies on the school enterprise cooperation mechanism to implement the teaching and production training and fixed position practice with the alternation of work and study[3]. The school and enterprises jointly formulate talent training plans, share equipment resources, jointly manage the teaching process, and jointly control the teaching quality, so as to realize the close connection between professional construction and industry. Through the deep participation of enterprises in the formulation of talent training programs, curriculum construction and textbook construction, a "double subject" [4] talent training mode has been established to achieve the talent training goal of cultivating craftsmen with the spirit of "dedication, lean, focus and innovation".

(2) With "project driven and skill strengthening" as the core, we will implement layered teaching and form a new ecology of "special training, comprehensive training, competition training and innovation training" four in one practical teaching.

Building a practical curriculum system of "project driven and skill strengthening" [5] for mechanical and electrical majors through the integration of industry and education. The practice teaching items corresponding to the practice curriculum system should come from the enterprise engineering examples, cover the corresponding job responsibilities of the major, and include the specific contents and steps involved in the work of the Electromechanical Specialty. With the cultivation of students' professional ability as the main line and the strengthening of students' post skills as the core, starting with the students' required professional post ability, according to the professional talent training plan, the joint enterprise will jointly analyze the post professional ability, and attribute the knowledge, skills, professional quality, etc. required by the positions of mechanical and electrical students after graduation to the corresponding courses, so as to realize the cultivation of students' professional ability, innovation and entrepreneurship ability. Form a four in one practical teaching mode of "basic skills training - special skills training - comprehensive skills training - post skills practice".

(3) Based on the principle of "task orientation and progressive ability", focusing on classroom reform, a practical teaching curriculum standard characterized by "small course projects, large semester projects and general graduation projects" has been established.

In the process of practical teaching, the research group, guided by the requirements of skill competitions and actual posts, takes the basic ability and professional quality required to meet the requirements as the main line, and combines the students' own characteristics, divides the electromechanical professional training courses into four stages: "cognitive training, professional skills training, comprehensive training and post practice". Through the four stage teaching link, according to the competition mode and content of the electromechanical skill competition, integrating the ability requirements of the skill competition and the job requirements of the enterprise, the cognitive objectives, skill objectives and emotional objectives of the electromechanical professional practice courses are reorganized and arranged respectively, so that the designed teaching modules can meet the job requirements of the skill competition projects and related enterprises, so as to compile the core curriculum standards of the Electromechanical Specialty.

2.2. Taking Engineering Practice as The Core, Create A Three-Level Progressive Engineering Training Platform

With the goal of building a vocational training base featuring "parallel training and production, integration of teaching and production, connection between classroom and post, consideration of assessment and textual research, and integration of production, learning, training and examination", a three-level progressive engineering practice training platform featuring "engineering foundation, engineering special, and Engineering synthesis" is created in accordance with the standards and norms of the electromechanical industry.

First, referring to the national professional qualification advanced maintenance electrician appraisal standard, integrate the electronic training room, electrician training room, electronic design and production integration Professor, EDA simulation training room, fitter, lathe worker and other training rooms to cultivate the basic skills of electromechanical students, and create a professional basic skills training room based on "engineering foundation".

The second is to meet the job skills and professional quality requirements of enterprises, create a professional core skills training platform based on "engineering projects", and build a double qualified teaching team with a certain theoretical level and skilled practical ability.

Third, integrate the objectives of the National Vocational College skill competition and the world skill competition of Electromechanical Specialty, create a professional comprehensive training platform based on "engineering synthesis", and build a famous teacher level teaching team with certain influence in industry enterprises.

Through the three-level progressive engineering practice training platform of "engineering foundation, engineering special project and engineering synthesis", the research group integrates practical teaching, vocational qualification, engineering practice and competition training, and improves students' three types of engineering abilities: cognition + exploration, practical training + design, and engineering implementation + innovation, which reflects the gradual nature of ability training.

2.3. Taking the School Enterprise Cooperation as An Opportunity to Establish the Operation Mechanism of Practical Teaching

In order to ensure the normal implementation of practical teaching, the research group has worked closely with enterprises to write and formulate a series of rules, detailed rules and relevant systems:

First, the practice teaching plan, course practice teaching standard, course practice teaching implementation plan and detailed rules, productive teaching training plan and detailed rules, fixed post practice plan, graduation design, practice teaching management specification and implementation plan and other practical teaching specifications, systems and management regulations have been formulated for the Electromechanical Specialty.

Second, the management rules and regulations for teachers and their practical teaching behaviors have been formulated. Practice teaching and practice teaching design can not be undertaken and completed by the practice instructor alone, but also need to be completed jointly by professional teachers, course tutors, professionals in the practice teaching base and practice tutors .

Thirdly, it has written the management rules and regulations for the quality monitoring of practical teaching and the assessment and evaluation methods of practical teaching. For example, the management of practical teaching management mode and operation mechanism, the management of practical teaching feedback information, the management of practical teaching design, the assessment and evaluation scheme of students' practical teaching, etc .

3. Innovation and Application Effect of The "Three-Level Progressive and Four in One" Practical Training Mode

3.1. Innovation and Characteristics

(1) The practice courses of Electromechanical Specialty with "foundation strengthening, project driving and engineering practice" as the core have been constructed .

The Electromechanical Specialty of our college has successively signed school enterprise cooperation agreements with Fangda Zhichuang Technology Co., Ltd., Funeng Technology Co., Ltd., and Gree Electric Appliance (Ganzhou) Co., Ltd., implemented order based training characterized by "integration of production and education, and alternation of work and learning", and built a "four stage" practical teaching link .The research group has innovated and reformed the practical teaching of Electromechanical Specialty, and achieved good results after 3 years of practice .An engineering practice curriculum system with "foundation strengthening, project driving and engineering practice" as the core has been established,According to the characteristics of professional posts of mechanical and electrical majors, practical teaching standards based on business processes and professional posts have been formulated, and the integration of courses, production and competition has been explored in some core professional courses, which has improved the quality of practical teaching and students' employment .

(2)It integrates the three-level progressive practical teaching platform characterized by "engineering foundation, engineering specialty and engineering synthesis" .

Through the integration and reconstruction of the original basic training room, comprehensive training room, skill appraisal training room and provincial competition base, A three-level progressive practical teaching platform of "engineering foundation, engineering special project and engineering synthesis" has been built. Each platform supports each other, integrates organically, connects scientifically and advances gradiently, and has truly built an engineering practice platform integrating teaching, competition training, engineering practice and innovation training. It provides a new method and paradigm for training high-end high-tech talents with craftsman spirit.

3.2. Application Effect

(1) The teaching effect is obvious, and the comprehensive quality of students is obviously improved.

Since the implementation of practical teaching reform, the proportion of practical courses has increased. The teaching items of the practical course mainly come from the real cases of enterprises and the competition questions of the National Games. They are highly practical and can reflect the typical post skills of electromechanical majors. Therefore, students' enthusiasm for participation has been greatly improved. Students who want to do it, dare to do it, and can do it. Students' professional skills, ability to use theoretical knowledge to solve practical problems, team competition and cooperation and other comprehensive qualities and abilities have been significantly improved.

In the past three years, the employment rate of electromechanical graduates in our school has exceeded 92%, and the employment quality and professional counterpart rate have increased year by year. At the same time, students won 6 first prizes, 15 second prizes and more than 20 third prizes in provincial competitions. He won 2 second prizes and 2 third prizes in the national competition. Through the follow-up survey of recent graduates, students have received comprehensive and systematic engineering practice training during school, which has been widely praised by the society.

The teaching level has been steadily improved, and teachers have won a number of teaching awards.

Teaching reform has also improved teachers' practical teaching ability in reverse. Teachers' teaching methods and means have become more diversified, and teachers' professional quality has been improved; We have built a team of teachers with a dual teacher structure that combines full-time and part-time work, has a reasonable knowledge structure, has rich practical experience, and is in the prime of life. It has produced a number of teaching and research achievements with strong operability. It has cultivated backbone teachers with extensive influence in teaching research, industry training.

4. Conclusion

Through the "four stage" practical teaching link, the research group develops project-based practical teaching resources, implements task-based teaching and assessment, embodies the cultivation of craftsman spirit throughout the process, and comprehensively improves students' comprehensive professional ability. Through three years of practice, a new practical teaching path of electromechanical class has been formed, which is suitable for the regional characteristics and the educational reality of our university. It has built a "three-level progressive" practical teaching platform, formulated a practical teaching operation mechanism, created a team of teachers with excellent morality and professional skills, and increased teaching investment. The school running conditions for practical teaching have been fundamentally improved.

Acknowledgments

This work is supported by the Research project on education and teaching reform of undergraduate universities in Fujian Province (Grant No. FBJG20200240), Ningde Normal University's teaching connotation construction and improvement project (Grant No. JG2020007 and Grant No. JG2022005).

References

- [1] Chen Chao Li Min etc. Exploration and practice of "integration curriculum" based on the talent training mode of "three integration and four environments"-Taking the basic courses of electromechanical majors in Higher Vocational Colleges as an example. *Industry and information technology education*. 2022, (04): 43-47.
- [2] Wang Junyi . Practical research on implementing the talent training mode of deep integration between schools and enterprises in electromechanical Majors. *Heilongjiang Science*. 2020, 11(23): 60-61.
- [3] Lei Hongmei, Zuo Jianglin etc. Research and Practice on constructing the training mode of "front-line three training, spiral progression" Engineering Majors. *Equipment Manufacturing Technology*. 2019, (06): 128-132.
- [4] Han Shuming . Practice of talent training mode for Mechatronics Technology Majors in Higher Vocational Colleges Based on "dual system". *Vocational and Technical Education*. 2012, 33(35):5-9.
- [5] Shenbinde, Zhongshengren etc. Research and Practice on the talent training mode of mechatronics technology based on the systematization of work process. *EDUCATION TEACHING FORUM*. 2015, (09): 127-128.