Curriculum and Teaching Methodology (2026)
Clausius Scientific Press, Canada

DOI: 10.23977/curtm.2026.090302
ISSN 2616-2261 Vol. 9 Num. 3

Exploration of Practical Teaching Reform in Production Internship for Mechanical Design, Manufacturing and Automation (Sino-German Joint Program)

Chunling Li[1,2,a,*], Yufeng Lu[1,2,b]

[1]School of Mechanical Engineering, Shandong Key Laboratory of CNC Machine Tool Functional Components, Qilu University of Technology (Shandong Academy of Sciences), Jinan, 250353, China
[2]Shandong Institute of Mechanical Design and Research, Jinan, 250031, China
[a]lcl_Alice@126.com, [b]luyf78@126.com
[*]Corresponding author

Keywords: German Enterprise Elements, Sino-German Cooperative Major, Practical Teaching Reform

Abstract: Mechanical Design, Manufacturing and Automation (Sino-German Joint Program) imposes higher requirements on students' engineering practical ability, professional norms, craftsmanship spirit and international literacy. As a core part of practical teaching, production practice has long been plagued by problems such as disconnection between content and enterprise positions, low practical standards, loose process management, and insufficient school-enterprise collaborative education. Relying on the advantages of Sino-German cooperative education, this paper systematically integrates German enterprise elements, including German technical standards, dual-system training mode, lean production concept, 5S site management, craftsmanship spirit and quality control system, into the construction of internship bases. On this basis, it reconstructs internship objectives, optimizes curriculum content, innovates teaching organization modes and improves diversified evaluation systems. Practice shows that the construction of German enterprise-oriented internship bases has greatly promoted the reform of production practice courses, effectively improved students' engineering practical ability, post adaptability and professional literacy, and enhanced the consistency between talent training and the needs of German-funded enterprises and high-end equipment manufacturing enterprises. It has demonstration and popularization value for the practical teaching reform of engineering majors under Sino-German cooperation.

1. Introduction

Production internship is a mandatory part of the talent training program for mechanical major (Sino-German joint program). It is a teaching process that cultivates students' ability to connect theory with practice and exercises their practical skills. Through production internships, students can gain in-depth exposure to the front line of the profession, thereby reinforcing their theoretical

knowledge. Students' participation in production internships can also stimulate their professional potential, cultivate their awareness of environmental protection, and further develop their ability to apply professional knowledge to solve engineering problems. However, there are currently the following issues with production internships. Firstly, the production internship often takes the form of cursory visits, leading to low enthusiasm among students. Secondly, there is a lack of internship bases characteristics of mechanical major (Sino-German joint program). The existing internship bases do not incorporate enough German corporate elements, which cannot assist students in working for German-funded enterprises. Lastly, the evaluation system for production internships is quite simplistic. Therefore, the comprehensive reform of the production practice teaching system is imminent [1].

2. The Main Teaching Objectives of the Production Internship Course

Production internship is an important compulsory practical course focused on mechanical major (Sino-German joint program), and it is also an important practical teaching link before graduation design. Production internship can deepen students' understanding of the position and role of their major in the national economy. The process of production internship can also cultivate students' sense of professionalism, mission, and pragmatism, and even reinforce their professional thinking. During the production internship, students can consolidate and apply the knowledge learned from various courses, and combine theoretical knowledge with practical production, thereby cultivating their perspective on mechanical manufacturing processes, training their abilities to observe, analyze, and solve practical engineering problems, and fostering their independent work and practical operation skills. Production internships enable students to acquire practical knowledge and skills related to professional production. Students can also learn about operational control and production management, thereby cultivating their hardworking spirit and willpower. By participating in production internships, students apply the professional knowledge and skills to actual production, thereby consolidating and enriching their theoretical knowledge and cultivating their ability to handle practical problems. More importantly, students also understand the connotation and significance of environmental protection and sustainable development in engineering practice, laying a solid foundation for them to independently engage in professional work after graduation.

3. The Existing Problems

3.1. The Low Students' Enthusiasm for Internships

The production internship for our school's mechanical major (Sino-German joint program) is conducted in the fifth semester. At that time, students have just completed the study of several professional basic courses, and many professional courses have not yet begun. It is difficult for students to integrate their professional theoretical knowledge into engineering practice at this stage. Many students have a low level of professional awareness, and even some students feel lost in the development of their industry. In addition, many students are dissatisfied with the production environment in machinery-related enterprises, which in turn leads to resistance towards employment in the industry. All the above reasons have caused students to lose interest in practical sessions, resulting in extremely poor subjective initiative [1]. They participate in internships passively, merely with the intention of earning credits, ultimately failing to achieve effective internship results.

3.2. Lack of Internship Bases Suitable for Professional Characteristics

Currently, the internship base for mechanical major (Sino-German joint program) is mainly jointly established with ordinary mechanical major, so the internship base lacks professional characteristics and the integration of German enterprise elements is insufficient, which cannot assist students in working for German-funded enterprises. Our school lacks policies and funding guarantee systems to promote sustainable construction of the base , and the school's goal orientation is not sufficiently aligned with the demands of enterprises. The relevant institutional construction of the school is incomplete, and some systems violate the laws of enterprise operation and production, deviating from the reality of industry development and industrial upgrading. They fail to take into account the "feelings" of enterprises in terms of internship time and internship coordination. To some extent, students' production internships disrupt the normal production and operation of the companies. Therefore, enterprises need to allocate some of their technical backbones to guide the students' internship, while also considering relatively hidden risks such as internship production coordination, internship safety, and technical leaks, which are contradictory to the enterprises' pursuit of efficiency and profits.

3.3. The Monotonous Evaluation System

Currently, the comprehensive score for production internship is determined by students' attendance, internship diaries, and internship reports. The evaluation system emphasizes reports while neglecting the process. This evaluation system only focuses on results, without considering students' learning attitude and internship process, which does not align with the evaluation standards of German-funded enterprises.

4. The Main Content of Curriculum Reform

In order to cultivate students' engineering practice abilities and enhance their capacity to apply professional knowledge to solve complex engineering problems, the reform of the production internship course centers around the German dual system concept. By integrating the characteristics of mechanical major (Sino-German joint program), German corporate elements are incorporated into the construction of internship bases. This approach aims to reconstruct course objectives, optimize course content, innovate teaching mode, and improve the diversified evaluation system.

4.1. Establishment of Internship Bases with Professional Characteristics

German precision machining specifications, assembly processes, testing standards, and equipment operation procedures are introduced in the construction of internship bases. Thus, the practical training content can be aligned with the job requirements. We carry out segmented and progressive internships, utilizing both school and enterprise settings, with dual mentors from both school and enterprise. These factors, such as process quality control, zero-defect awareness, continuous improvement, standardized operations, process optimization concepts, and quality awareness, are integrated into the production internship process. During the production internship, we implement safety standardization and workstation normalization to create an authentic on-site corporate atmosphere. Instructors cultivate some professional qualities that are in line with the preferences of German enterprises for their employees, such as punctuality, standardization, rigor, responsibility, collaboration, attention to detail, high quality, and so on. A distinctive internship base has been established. It adheres to German enterprise management standards, closely aligns with precision machinery/intelligent manufacturing positions, fosters deep collaboration between

schools and enterprises, and operates stably. Such internship bases can support the transformation of production internships from a "cognitive-based" approach to a "job-specific practical and comprehensive ability-based" approach.

4.2. Establishment of Internship Bases with Professional Characteristics

To ensure the high-quality completion of internship teaching tasks, a relatively complete production internship system has been established, which has basically achieved the institutionalization, scientification, and standardization of production internship teaching work. The internship system includes the "Production Internship Outline", "Production Internship Plan", "Production Internship Manual for Instructors", "Production Internship Requirements for Students", and "Production Internship Assessment Methods". The establishment of the management system for production internship not only standardizes the practical teaching process but also highlights the importance of practical teaching and ensures its quality [2].

4.3. Establishment of School-Enterprise Collaborative Education Mechanism

Although university teachers possess a strong foundation in professional theoretical knowledge, they generally lack practical engineering experience. In view of this, during the reform process of production internship courses, we actively explore ways to broaden the participation of enterprises in internship teaching. The main measures include the following. We promote mutual employment between professional teachers and enterprise technology personnel and invite enterprise personnel to participate in the writing of internship plans and task guides, internship program design, internship process management, and internship performance evaluation. At the same time, we also promote the sharing of high-quality resources between schools and enterprises and accurately connect with enterprises based on professional advantages. The internship programs are designed according to the needs of enterprises. Taking the process of student production internships as an opportunity to provide technical support and talent training, and solve the shortcomings of actual production in enterprises. The school's guidance teachers collaborate with enterprise mentors to implement internship management and guidance, while enterprise mentors are responsible for providing on-site business guidance to students. The school invites enterprises to participate in the assessment of the production internship process, in order to enhance the role awareness of enterprise mentors in internship process management. Schools and enterprises cooperate to establish internship teaching or industry university research cooperation bases, providing convenience for enterprises in talent cultivation, scientific and technological research and development, technical training, social services, etc., thus achieving mutual support, resource sharing, and complementary advantages between schools and enterprises [3]. Through the above attempts, the enthusiasm of enterprises to participate in the production internship teaching process has been enhanced. The deep cooperation between schools and enterprises has been promoted, and the effectiveness of production internship teaching has been improved.

4.4. The Management of Production Internship Process

The school inspected the production internship base from the five aspects, namely on-site safety, internship content, incentive measures, student assessment, and implementation of rectification to fully utilize the functions of production internship management institutions, timely understand the teaching effects of production internships. The specific regulatory work is divided into four aspects and runs through the entire process. Firstly, the vice dean in charge of teaching and teaching management personnel of the college shall inspect the preparation of each stage of the internship

before the internship begins. Secondly, teachers from the school's academic affairs office and supervision team will conduct on-site inspections after one week of internship. Thirdly, enterprise mentors inspect students' safety, teachers' explanations and the arrangement of various workshop processes and occupations throughout the entire process. Fourthly, the person in charge of practical teaching in the school tracks the implementation of the teaching plan throughout the entire process. Through the supervision and management of the entire process, schools can grasp the overall situation of production internships and create a good environment for them, thereby promoting the continuous improvement of the quality of production internship teaching [4].

4.5. Reform of the Evaluation System for Production Internship Courses

A reasonable production internship evaluation system should be student-centered, focusing on comprehensive evaluation of the entire internship process, that is, tracking and formative evaluation of the internship throughout the process. The assessment of production internship is a test of students' mastery of knowledge and practical ability, and the assessment results should truthfully reflect students' internship situation. Although the characteristics of practical teaching determine the complexity of assessment, it is still necessary to standardize assessment and comprehensively evaluate students' internship performance. At the same time, the school invites enterprises to participate in the process assessment of production internships, in order to establish a diversified evaluation mechanism for student internship results that combines school enterprise cooperation, enterprise centeredness, and comprehensive evaluation, as shown in Table 1 [5].

Table 1 The Evaluation System for Production Internship Courses

Evaluation Item	Ratio(%)	Evaluation Method
Internship performance	30	Attendance rate, work enthusiasm, work results, and teamwork situation
On site assessment	15	Inspection of on-site processes and technical issues by factory technicians for students
Interview assessment	15	Professional theoretical knowledge and related processes, typical case analysis
Internship Diary		The richness of the content in the internship diary
Internship Report		Content and format of internship report

5. Conclusions

Production internship is an important part of quality education in universities, and it’s effectiveness is the most direct manifestation of students' mastery of theoretical knowledge. Production internship is of great significance for enhancing the professional proficiency and ability to integrate theory with practice of students majoring in mechanical engineering. The reform of the production internship teaching link is a long-term and arduous task. We have conducted research and exploration on the main issues in production internships and have explored a production internship model that adapts to the new situation, while also laying a solid foundation for subsequent practical course learning. The results have been positive after being verified by students who participated in internships for two consecutive years from 2025 to 2026.

Acknowledgements

This work was financially supported by 2025 research project of School of Mechanical Engineering, Qilu University of technology.

References

[1] Song Xuyan, Chen Deng, Jiang Zhengping, et al. Exploration of Practical Teaching Reform in Production Practice for Material Engineering Major [J]. Shanxi Architecture, 2021, 47(21): 182-184.
[2] Wang Jianhua. Reform and Practice of Production Practice in Mechanical Design, Manufacturing and Automation Major [J]. Journal of Yangtze University (Social Science Edition), 2008, 31(06): 259-260
[3] Wang Faxiang, Yan Dan, Yu Jian, et al. Teaching Reform of "Production Practice" Course for Food Major Based on Industry-Education Integration [J]. Agricultural Product Processing, 2023, (10): 99-101
[4] Li Aimin, Zhang Wei, Liu Tonggang. A New Production Practice Model for Mechanical Engineering Major [J]. Experimental Technology and Management, 2017, 34(11): 16-18
[5] Li Yichen, Xing Tieling, Wang Wenli, et al. Reforming Production Practice in Light Chemical Engineering Major to Boost the Cultivation of Innovative and Practical Talents [J]. Chemical Engineering Management, 2024, (15): 36-39.