

Exploration and Practice in Enhancing the Effect of Production Practice of Mechanical Design, Manufacturing and Automation Major

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Abstract

Production practice is one of important practical teaching steps for Mechanical Design, Manufacturing and Automation Major in engineering colleges and universities. The authors of this paper firstly analyze problems existing in production practice. Then, the authors put forward approaches to enhance the effect of production practice based on the reality, such as strengthening construction of internship base, adjusting and upgrading the mode of production practice, consolidating construction of the team of internship teachers and intensifying assessment on internship of students.

Keywords: Mechanical Design, Manufacturing and Automation, production practice, problems, approaches.

1. Introduction

Production practice is one of important practical teaching steps for Mechanical Design, Manufacturing and Automation Major in engineering colleges and universities. Production practice helps students to apply the theoretical knowledge that they have learnt in the classroom to production practice, which further improves the quality of study. By means of getting access to the actual production, students are likely to personally experience the operating mode of an enterprise and acquire the preliminary training on engineering technology and corporation management. They can have a better understanding of the traditional technologies and advanced technologies of the industry and set up a preliminary consciousness of engineering. In the meantime, this step is also a preparatory phase for students' graduation project. The production practice helps students to improve their ability to

discover problems, analyze problems and solve problems and lays a solid foundation for students to make their graduation designs. Nevertheless, at present, the engineering colleges and universities still have a lot of problems in production practice. This paper discusses the problems existing in the production practice of the Mechanical Design, Manufacturing and Automation Major and the approaches to enhance the effect of the practice based on the actual production practice in Changchun University of Science and Technology^[1]. (Guo, Liu, & Liu, 2006, 103-104)

2. Current Problems Existing in Production Practice

The primary aim of production practice is to let students get more access to the actual production, understand the production technique and equipment and lay a solid foundation for study of specialized courses. Thus, the practice base is required to meet certain needs on sites and technical support. Currently, with reform of the economic system and the development of higher education, the Mechanical Design, Manufacturing and Automation Major is faced up with some unavoidable difficulties, which are mainly reflected in the following five aspects.

2.1 Difficulty in the Foundation of Production Practice Base

Previous practice bases are mostly state-owned enterprises. With re-organization and re-construction of these enterprises, the practice bases which are originally lacking lose more seriously. In addition, enterprises focus more on economic benefit and safe production. Yet, swarm of a large quantity of practice students into the enterprises will be bound to bring about more burdens and inconvenience to the enterprises. Furthermore, out of the consideration of technical protection and production environment, the enterprises show less enthusiasm in providing production practice for graduates. Even if they settle for the graduates under the stress of cooperative relationship with the colleges and universities, they would not allow students to participate on site in some key fields. Due to various reasons, colleges and universities meet a lot of difficulties in finding practice bases

2.2 Difficulty in the Management of Practice Students

Difficulty in the management of students in production practice generally exists in colleges and universities. Students enrolled in 2014 majoring in the Mechanical Design, Manufacturing and Automation Major in our college are taking as an example here. At present, there are 195 students in this major. The site for students' production practice is located in the economic development zone in Changchun city and it costs nearly two hours to drive there from our university. Each time, the university needs to rent five buses to journey to and fro between the practice base and the college. This causes great hidden danger in the traffic security. Besides, according to the practice contents, students of our college are sent to different areas of the factory. As a result, the teachers in charge of production practice have great difficulties in examining the entire practice situation of the students. Some students are indolent and have no enthusiasm in production practice, which also brings a lot of difficulties to the team-lead teachers for their management.

2.3 Inadequate Expenses for Production Practice

Colleges and universities have the special expenditure for production practice. However, with economic development, expenses for traffic, board and lodging during the production practice all increase constantly. Furthermore, the practice units also increase the expenses for production practice to different extents. However, the expense for production practice offered by universities increase slowly, which causes inadequate expenses for production practice and also difficulties in expanding the contents of production practice. As a result, it is difficult to achieve the expected effects. Some practice content which is supposed to be studied in greater depth can only remain on the level of looking, listening and recording due to the limitation of the expense. As a result, the effect of production practice is greatly reduced.

2.4 Unoptimistic Effect of Production Practice

In traditional production practice, students usually come to the practice unit under the leadership of their teachers. After the introduction to safe production given by the team-lead teachers or the person in charge of the practice unit, students will be grouped and sent to different workshops for visit and study. Since time is limited, students have short time to pay attention to a certain process or equipment. They have to visit next workshop before they can fully understand the technological process of the whole processing. So students don't have enough time to combine theories with practice. Moreover, students have no opportunity to take part in specific production practice. Finally they lack positive attitudes towards the production practice and even feel bored. It fails to achieve an ideal practice effect.

2.5 Deficiency of Team-lead Teachers

The team-lead teachers play a critical role in the whole process of production practice. A team-lead teacher is responsible for students' personal security and also the interpreter of professional knowledge. Therefore, the team-lead teacher needs to possess abundant professional knowledge in addition to an intense sense of responsibility. Nonetheless, university teachers are busy with scientific researches and teaching tasks. The teachers capable of teaching are arranged with important teaching tasks of specialized courses or heavy scientific research tasks. In contrast, those teachers who have both the time and energy to guide the practice usually do not have rich experience in teaching and are lacking in professional knowledge or experience. The quality and quantity of team-lead teachers are unable to meet the requirements of production practice which influences the certain effect of production practice.

3. Approaches to Enhance the Effect of Production Practice

3.1 Strengthening the Construction of the Practice Base

3.1.1 Consolidating Old Practice Base

Changchun University of Science and Technology has set up its production practice base in Changchun First Automobile Group Corporation for over two decades. The First Automobile Group Corporation has plump production tasks, strict management system and advanced production equipment. All these satisfy our requirements for the production practice base. Although the corporation has also undergone re-organization and re-construction, our cooperation relationship has been maintained well in the past two decades. It benefits from the continuous consolidation on the cooperation relationship. On one hand, we have sent a large number of excellent undergraduates and postgraduates to Changchun First Automobile Group Corporation over the past years. At present, most of graduates from our university become the backbone of production of middle-level managers in this corporation. Thus, this corporation is quite satisfied with the comprehensive quality of our graduates, which lays foundation for our cooperation in the long run. On the other hand, the university has tapped its superiority by providing great technical support to the First Automobile Group Corporation in terms of technical innovation and production research and development. This kind of industry – university – research cooperation brings benefit to both universities and enterprises.

3.1.2 Establishing New Practice Bases

Our university continues to establish new practice bases as well as consolidate old practice bases. It is investigated that there is large room for cooperation between some well-known private enterprises or joint venture enterprises and universities. On one hand, each year, the enterprises have demands on the majors in our university and they need increase the reputation of the enterprises through the platform of our university. On the other hand, the enterprises hope to solve their technical issues with the scientific research advantages of our university. Under such circumstance, our university has tried in many ways to establish

production practice bases with several enterprises, such as, Changchun Dacheng Industrial Group Company LTD., Changchun Hella Automotive Lighting Co., Ltd. and Changchun Huiwei Technology Development Co., Ltd.. During the practice, students are able to fully realize the internal advantages of flexibility and competitiveness of private enterprises and are more likely to find their own advantages and potentials. At the same time, the enterprises are able to make preliminary selection for their future recruitment through practice assessment. This helps to achieve win-win.

3.1.3 Strengthening the Construction of Campus Practice Base

On the premise that it is difficult to find the practice base off campus, our university has enlarged its strength on the construction of practical training center on campus. The engineering training center of our college further sets up three departments, namely, the practical training department of basic manufacturing technology, the practical training department of advanced manufacturing technology and department of condition security. The practical training department of basic manufacturing technology further sets up six teaching training workshops, which include the nine types of work of turner, miller, planer, grinder, casting, punching, welding, bench worker and heat treatment. The practical training department of advanced manufacturing technology further sets up four teaching training workshops, which include the five types of work of numerical control lathe, numerical control milling, numerical control machining center, numerical control wire-electrode cutting and precision measurement. On the basis of integrating, optimizing and enhancing the quality of practical teaching, the practical training center positively taps its current potential in teaching resources and strengthens cultivation and training of students' consciousness and capacity of innovation. It also furnishes support for scientific research, university students' innovative practice and service for enterprises, etc. Currently, the engineering training center in our university has formulated its practical training and teaching system with benign equipment, advanced technology, perfect system, strict management, standard teaching and coordinated operation. The center stands at an advanced level among all universities of the same kind in Jilin province in terms of teaching hardware, software and management. Through the practice in the practical training center, both the operational and practical capacity and the innovation capacity of students have been greatly enhanced. The students in the university have carried off prizes frequently at national mechanical design competitions and scientific and technical innovation competitions and won honors for the university in the past few years.

3.2 Adjusting and Upgrading the Mode of Production Practice

3.2.1 Self-compilation of the Teaching Materials

In order to ensure that students have in-depth knowledge of the practice contents before the practice starts, our college has independently compiled specialized teaching materials for production practice. The teaching materials include the contents related to the practice, such as the aim, task requirements, practice content and methods, time requirement, specific procedures, relevant professional knowledge and methods of assessment. Students can have a preliminary understanding of the practice through learning the teaching materials prior to the practice and make adequate preparation for it^[2]. (Li, Li, & Zhang, 2011, 26-27)

3.2.2 Combining Special Lectures with On-site Interpretation

In order to obtain better practice effect, our college arranges a lecture on special topics prior to each production practice step, in which professional teachers give detailed illustration on the structure of key machine tools and the critical positions. 3D animation enables the students to have more intuitive and vivid understanding of the processing process of products. Besides, after the lecture, questions of reflection are prepared for students to search answers in the process of practice. It enables students to have a definite object in the practice and avoids blindness. On the practice site, professional teachers give lectures and solve the problems that the students do not understand in time. The above method greatly enhances the effect of the practice.

3.2.3 Combining Off-campus Study with On-campus Practical Training

At present, off-campus practice bases sometimes cannot satisfy students' needs to practice on site due to limits of factory site, security factor and so on. In order to further enhance students' operational and practical capacities, our university combines off-campus practice with on-campus practice. Students are regularly arranged to go to practical training center on campus and take part in product design, technical design, the programming of processing procedures and the actual processing and assembly of products. This not only enables students to further digest the professional knowledge in practice, but also exercises students' practical capacity and receives benign effects.

3.2.4 Broadening Students' Horizon and Arousing Their Interests

With constant development of science and technology, university students have had profound interest in modern advanced technology and are no longer satisfied with the traditional production modes and production technology of practice units. In this regard, our university has adopted several modes to broaden students' horizon. For instance, our university organizes students to visit the automobile production line of Changchun FAW-Volkswagen. The students are directed to view and emulate the production process of numerically-controlled machine tool in the CNC machining center. They also go to several workshops to view and emulate the working process of welding robot. Besides, working staffs in the research and development center of the factory are invited to give lectures for students on the working principle of advanced equipment. Deeply appealed to the advanced production equipment, modernized production assembly lines and strict management modes of the enterprise, students are confident with their career that they will be engaged in the future. It helps students to better participate in production practice and learn professional knowledge in the future.

3.3 Strengthening the Construction of the Team-lead Teachers

The team-lead teachers are not only the organizer and manager but also the instructor of production practice. They are required to possess certain organizational capacity, high level of theoretical teaching and strong capacity in engineering practice. Our university has adopted two modes to strengthen the construction of the team-lead teachers.

3.3.1 Cultivation Mode: Experienced Team-lead Teachers Guiding Team-lead Young Teachers

It is required that young team-lead teachers should have at least two years' experience in guiding students' production practice. This is also regarded as a necessary condition for teachers' professional evaluation and promotion of professional titles. When young teachers guide students' practice, the mode of grouping, "one helps one", is adopted for young teachers. The experienced teachers assist young teachers to get familiar with the work requirements of production practice as soon as possible and improve their capacity in engineering practice^[3]. (Zheng, Guo & Luo, 2004, 177-179)

3.3.2 Strengthening Training on Team-lead Teachers

In this regard, the mode of going out and inviting in is adopted. Teachers are regularly arranged to take part in skill training organized by the province and the city. In 2014, our college successively sent more than twenty teachers to take part in the training on advanced manufacturing technology and mechanical engineers and learn and understand advanced leading-edge technology and the developmental trend of advanced technology in the mechanical field at present. In order to enable our teachers to have a deeper understanding of the specific situation of actual production and existing problems at present, more than ten top specialized persons from well-known enterprises were invited to give lectures or teach classes. This provides knowledge and technical support for teachers to guide students' production

practice.

3.4 Strengthening Assessment on Production Practice

A rational production practice assessment mode can bring students with proper pressure and mobilize students' enthusiasm in production practice. It can also truly reflect the situation of students' performance in production practice and provide reference for teachers in following teaching. Our college has adopted the following methods to assess students' practice.

3.4.1 Reform of Assessment Items and Modes

The traditional mode that evaluates the performance based on the internship report is altered. The assessment items are divided into four parts: attendance rate, performance at ordinary times, practice diary and practice report. In the assessment on internship, the college adopts the method of assessment by grouping. The students are divided into four to five groups according to their classes. And a leader is chosen from each group to be responsible for recording the attendance of the group members.

3.4.2 Refining Assessment Contents

Scores of the attendance are given by group leaders. The performance at ordinary times is evaluated by combining mutual assessment by group members with evaluation by teachers. The practice diary needs to be finished by students each day. The contents of the practice diary cover the characteristics of the processing equipment, the technical process and test methods and required preliminary sketches. Teachers adopt the qualitative method and the quantitative method to assess the performance of practice diaries every day. The practice report requires the students to write out their gains, experiences and inspiration in the production practice. The teachers will give comprehensive and objective scores based on the practice performance of students at ordinary times. Finally, the teachers synthesize the scores of these four aspects and make an overall evaluation of students in the production practice^[4]. (Lv, Gao, Li, & Wang, 2007, 28-31)

4. Conclusion

Production practice is an important part in the practical teaching in Mechanical Design, Manufacturing and Automation Major. The quality of the practice effect relates to students' subsequent courses learning and improvement of students' comprehensive ability. Only new approaches to improve the effect of production practice are continuously explored and studied and the organic combination of students, teachers and practice base are realized, can the university further cultivate students' innovation and practical capacity to better adapt to the need of economic and social developments.

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