Research on "3-4-3" Teaching Model of NC Machining Technology and Programming Course

Mei Tian [a] and Binghan Jiang [b]

College of Mechanical Engineering, Jilin Engineering Normal University, Changchun City, China

[a.]32593829@qq.com; [b.]1257346481@qq.com

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Abstract. The traditional teaching form of numerical control (NC) is relatively simple and monotonous. The theory and practice of this course are disconnected. And there is a big gap between the personnel training specifications of universities and the actual needs of enterprises, which leads to the weak adaptability of students to occupational positions. Influenced by such factors as teaching mode, hardware facilities, training time and faculty, most universities have low efficiency of numerical control teaching, long training cycle and uneven quality. With the rapid development of education informationization and the application of advanced manufacturing technology, it provides a multi-functional, all-round, wide channel and diversified display space for the teaching of NC course. Based on this environment, the "3-4-3" new teaching mode resets the teaching structure, successfully transforms the roles of teachers and students, creates conditions for students' individualized learning, communication, cooperation, practice and innovation between students and students, ensures the quality of personnel training, and also provides reference for the teaching of other disciplines.

Introduction

With the rapid development of science and technology, frequent changes in the relationship between supply and demand, and rapid changes in product updates, advanced manufacturing technology emerged as the times require. NC technology is one of the application fields of advanced manufacturing technology. It highly integrates the disciplines of machinery, electronics, computer and automatic control theory. It uses digital information to control the operation and processing of equipment programmably and automatically, so as to maximize the performance of machinery and equipment and push productivity to a new level. Using numerical control technology to realize production can effectively shorten the production preparation period, improve the automation degree of processing process, easy to manufacture complex parts, have obvious advantages such as high processing accuracy and good consistency of products, and can significantly improve the adaptability of enterprises to the market and comprehensive economic benefits. The steady development of enterprises needs the support of professional talents. Vocational education shoulders the responsibility of training high-quality workers and skilled talents in the production line. Schools should seize the opportunity to strengthen cooperation with enterprises and train high-quality knowledge-based, skill-based, collaborative and innovative talents.

Definition of Concepts

The teaching mode is a relatively stable teaching structure framework and activity flow based on certain educational concepts. It implements a complete teaching process in several stages. There are strict logicality and scientificity in each stage, and different teaching methods are used to accomplish specific teaching tasks to achieve the desired teaching objectives.

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Current Situation and Improvement Strategy of NC Course Teaching

Lack of professional teachers, lack of special funds, shortage of teaching equipment and weak source base seriously affect the quality of teaching and restrict the development of NC specialty. Through the multi-dimensional investigation and interviews among enterprises, teachers and students, it is found that the teaching effect of NC specialty is unsatisfactory, which exposes many drawbacks of the traditional teaching mode in personnel training. The lack of integrity, unity, adaptability and innovation in teaching and learning results in the obvious collision between the needs of enterprises and the comprehensive abilities of students during the period of employment, and makes the development of society and individuals. Be hindered.

Classroom Structure of "Teaching before Learning". "Teaching before learning" belongs to the traditional classroom structure, and the application mode of "teaching-learning-training" occupies a dominant position. Teachers have absolute command, control learning content, allocate learning time, and guide students to familiarize with and understand professional knowledge and master professional skills by means of lectures, demonstrations and discussions. Students only need to follow the teacher's ideas, imitate problem-solving steps, learn step by step, and accumulate experience through repeated exercises. Because of the unequal knowledge between students and teachers, students unconsciously rely on teachers, and their brains receive information reflexively, while the fine qualities of thinking, questioning and innovation are gradually eroded.

Whole Class Teaching and Simultaneous Teaching. Teachers carry out teaching activities according to the preset trajectory, and explain theories and analyze cases at a specific pace for all students. Students at different levels must study at a unified pace. In view of the important and difficult contents, the students with quick thinking and excellent results can quickly understand the principles and master the ideas and skills of solving problems, while the rest of the students need to spend more time rethinking in order to understand the new knowledge. Therefore, in order to complete the established teaching tasks in a limited time, teachers are apt to ignore the actual needs of students, unable to take into account personalized learning, resulting in excellent students "not enough to eat" and underachievers "not enough to eat".

Lack of Effective Interaction Between Teaching and Learning. Normally, teachers spend a lot of time designing the teaching process and preparing the teaching content carefully, and pay little attention to student's interest in the course. In order to accomplish the proposed teaching tasks, teachers constantly teach knowledge or display operations, subconsciously weakening classroom activities such as questioning, questioning and discussion in the teaching links. In the long run, students lose their initiative in the default teaching method and gradually indulge themselves, resulting in unsatisfactory teaching effect.

Differences in Personnel Training Specifications. School-enterprise cooperation has not gone deep into the essence, and there is no effective communication between them. Enterprises can not timely feedback employment information, school teaching content and lack of enterprise elements, eventually leading to talent training and skills requirements are disconnected, which not only affects the prospects of student's employment, but also can not meet the actual needs of enterprises.

Lack of Fluency Between Theoretical Teaching and Practical Teaching. The traditional teaching mode makes students accustomed to mechanical listening, paying attention to the construction of knowledge system, lacking the quality of questioning and the spirit of active exploration. When the theory is suddenly transformed to the training environment, students lack solid theoretical foundation and skills, and they will feel insecure and anxious when facing the processing parts of solid machine tools, thus affecting the training effect.

The Management of Practical Training Classroom is Very Difficult and the Teaching Effect is not Good. The training course is dangerous and safety responsibility is put in the first place. Due to the great differences in student's professional knowledge, operation level and self-restraint ability, processing problems occur frequently in practical teaching. Even after short-term professional training, most of the students can master the NC code and its use occasion skillfully, and operate the NC machine tools more skillfully. However, due to the lack of safety

awareness, product quality awareness and cost awareness, it is easy to appear knife bumping or workpiece scrapping in the training.

The Evaluation Method of Curriculum Assessment is Single. Under the impetus of curriculum reform, teachers integrate process assessment and goal assessment into the evaluation system to evaluate student's performance comprehensively, but the evaluation method is still limited to measuring student's ability by scores. The process assessment only reflects the student's attentiveness to class, the enthusiasm of answering questions and the correct rate of homework. The evaluation method is too one-sided to reflect the good change of students' acquisition of knowledge, and the target assessment can not reflect the characteristics of student's individualization and innovation. For example, in training tasks, schools rely on scoring rules to check the processed parts, while enterprises check and accept products according to the basic principles of size inspection, environment, tolerance requirements and surface roughness inspection standards, which are far from each other.

Research on "3-4-3" Teaching Model

With the support of information technology, micro-video is the main learning resource. Students use the open network environment to achieve personalized learning and knowledge transfer before class. In class, they complete the deep internalization of knowledge and skills acquisition through teaching activities such as communication, collaboration, individual counseling, experiment/practice. "Flip Classroom" has the following remarkable characteristics: 1. Integration of information technology and professional courses to support and promote learning; 2. Easy to achieve personalized learning and targeted teaching, improve teaching quality and efficiency; 3. Emphasizing the meaningful construction of knowledge and skills; 4. Cultivating student's ability of high-level critical thinking and problem solving; and 5. Cultivating students' consciousness of autonomy, cooperation and innovation.

Constructing "3-4-3" Teaching Model. The ultimate goal of NC teaching is to enable students to master professional theoretical basis and post vocational skills, and have greater potential for development and promotion in the future. Therefore, the teaching mode of NC course should conform to student's cognitive law and play a role in promoting and improving their studies. NC course is theoretical and operational. NC programming, NC machine tool operation and product inspection are the key points of learning. The training of student's thinking and ability is hindered by the limitations of training equipment and conditions. In order to reduce the negative impact caused by the lack of equipment and other factors, achieve the teaching objectives smoothly, and build a teaching model suitable for the development of our school with local characteristics. As shown in Fig. 1:

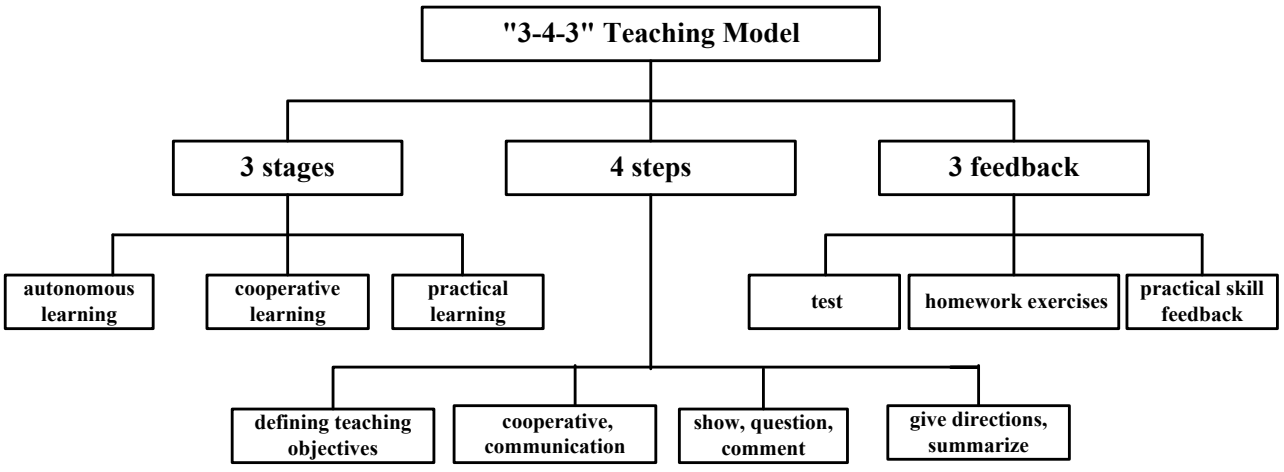

Figure 1： "3-4-3" Teaching Model

Construction of Double Teaching Platform. "Double Teaching Platform" refers to "Virtual Teaching Platform" and "Practical Training Teaching Platform". The teaching of NC course is supported by many related disciplines and is oriented to the production site. It has strong theoretical and practical significance. Due to the insufficient number of numerical control equipment and single system in secondary vocational schools, as well as the great potential safety hazards in the process of training, the transfer between theory and practice can be smoothly completed by means of the functions of "virtual teaching platform" such as modeling, automatic programming and simulation processing to strengthen student's practical ability, cultivate students' innovative consciousness, and take into account their individualized and multi-level development needs.“ Practice teaching platform "shows students the real processing scenes, and promotes students to consolidate theoretical basis and improve operational skills in practical application.

Teaching Model Interpretation. The teaching mode of "3-4-3" and the improvement strategy of "double teaching platform" are suitable for the application mode of the integration of theory and practice of NC course in our school. The following is a further interpretation of the connotation of the teaching model.

Pre-class guidance："Learning first" is the first step in the implementation of curriculum teaching. Under the guidance of teachers, students can achieve planned and step-by-step autonomous learning. Students are individualized learning subjects. Teachers change from traditional lecturers and decision makers to planners, guiders and supervisors of teaching activities.

In-class study：In-class study is the core part of "3-4-3" teaching mode, and also an important part of knowledge internalization. Students are freed from the traditional three-stage learning mode of "listening, taking notes and doing exercises", "eyes, ears, mouth, hands and heart" and are combined to improve their professional accomplishment in the environment of communication, exploration, collaboration, simulation, practice and innovation. At this moment, the role of teachers has also changed into senior coaches and learning partners of students.

Teacher's life in class overlaps with each other. Teachers organize groups to collect questions and solve them by group or class discussion and teacher comment; for the high error rate, high frequency of questioning and the core knowledge and skills defined by teachers, teachers can adopt holistic teaching supplemented by questions and answers, demonstrations and exercises; and for individual puzzles, one-to-one counseling can be adopted. In-class study meets the needs of student's in-depth study and internalized absorption. Learning community plays a key role in the seminar of "mutual teaching, mutual learning and mutual assistance". Small collectives create a learning atmosphere of exploration, seeking common ground while reserving differences and making common efforts to help students advance.

Introspection after class：After-class reflection includes both teaching and learning methods. Teachers rethink teaching design according to learning effect, remove turnips, and accumulate more rich experience for later teaching; students rethink learning attitude, learning methods and learning effect according to the assessment criteria, remove inferiority and preserve excellence, and promote later learning to a new height.

Conclusion

In order to construct knowledge system, enhance student's self-confidence, enhance their autonomy in learning and develop their innovative ability, we should integrate information technology with professional courses in numerical control teaching, adopt "3-4-3" teaching mode, implement a series of teaching activities to achieve the goal of talent training, stimulate students' inner potential, and guide students to seek knowledge and be realistic. Practice and innovation have become an effective teaching mode in the teaching of numerical control course and successfully accomplish the output of talents.

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