Teaching Practices Incorporating Philosophical Principles —The Example of a Machine Tool Teaching Course

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[**Abstract**] In the current social background, all college and university majors have carried out the construction of curriculum ideology and politics. And the philosophy of material dialectics as a scientific way of thinking in the ideology and politics teaching is an indispensable part. This paper takes the machine tool teaching course as an example, combined with the principles of dialectics in Marxist philosophy. It analyzes three major laws of material dialectics in machine tool technology, which helps students to cultivate critical thinking and innovation ability, and better analyze and solve problems. Not only to achieve the purpose of teaching professional knowledge, but more importantly to cultivate socialist builders and successors with all-round development of morality, intelligence, physicality, aesthetics and labor, and to contribute to the implementation of China's fundamental task of promoting moral education and cultivating more talents with high quality, ability and moral standard for the country and society.

[**Key words**] curriculum ideology and politics; machine tool technology; teaching practice; materialistic dialectics

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1 Introduction

Curriculum ideology and politics is an important concept emphasized by General Secretary Xi Jinping at the National Conference on Ideological and Political Work in Colleges and Universities, reflecting the comprehensive nature of education and the importance of ideological and political work. "At present, colleges and universities across the country offer 'Basic Principles of Marxism', 'Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics', 'Introduction to Xi Jinping's Thought on New Era Socialism with Chinese Characteristic', 'Outline of Modern Chinese History', 'Ethics and the Rule of Law', 'Situation and Policies' and other courses. These are not only important contents of curriculum ideology and politics, but also assume an important role as a model in curriculum ideology and politics. "Being able to maximize the attraction of college students to pay full attention and listen attentively in curriculum ideology and politics..... Receive the remarkable effect of integrating and understanding, getting into the ears and mind, and getting twice the result with half the effort, so as to achieve the fundamental task of curriculum ideology and politics in establishing morality and educating people". It emphasizes the necessity of integrating ideological and political elements into classroom teaching, not only in the political curriculum, but also in all disciplines. Its core is to make full use of classroom teaching as the main channel, and all kinds of courses and ideological and political theory courses in the same direction, in order to achieve synergy, and then the ultimate goal of collaborative education. In this concept, "establishing morality and cultivating people" is regarded as the fundamental task of education, that is, the

cultivation of students' moral quality should be placed in the primary position of the educational goal, and then the cultivation of professional skills. The importance of cultivating students' moral quality and humanistic accomplishment is emphasized. Under the concept of curriculum thought and politics, educators will pay more attention to shaping students' character in class and guide them to establish correct life goals and sense of social responsibility. In practice, colleges and universities can integrate curriculum ideology and politics into professional teaching in a variety of ways. On the one hand, through the innovation of curriculum and teaching methods, ideological and political elements can be organically integrated into professional courses. For example, through case studies, discussions, practical projects and other forms to guide students to think about and discuss professional-related ethics, social responsibility and other issues. On the other hand, by training teachers' ability and literacy, we can improve their understanding and practical level of ideological and political education, so that they can effectively carry out ideological guidance and values education in professional teaching. In addition, we can also establish and improve the relevant evaluation mechanism to monitor and evaluate the implementation effect of curriculum ideology and politics, so as to continuously improve and enhance the quality of education and promote its all-round development.

Machine tool is one of the core equipment in the manufacturing industry, and its role in industrial production cannot be ignored. Traditionally, machine tools are regarded as technical activities in a single field, mainly related to mechanical engineering and manufacturing processes. However, with the acceleration of industrialization and the continuous progress of technology, the number, scale and complexity of machine tools are increasing. This growth trend has given rise to new challenges and demand for machine tool research.

First of all, with the surge in the number of machine tools, the traditional design and operation mode of machine tools may no longer meet the needs of modern manufacturing. Emerging industries such as automation and digital manufacturing have put forward higher requirements for machine tools, requiring more advanced technology and intelligent machine tool equipment. Therefore, interdisciplinary research becomes very important. It involves the knowledge and technology of many disciplines, such as mechanical engineering, electronic engineering, computer science and so on. Secondly, with the expansion of its scale, machine tool involves a wide range of fields, such as supply chain management, production process optimization and so on. Large-scale machine tool production requires a comprehensive consideration of materials, energy, human resources and other factors, in order to achieve high efficiency and production quality. This requires researchers not only to understand the technical characteristics of the machine tool itself, but also to master interdisciplinary management knowledge and production technology. With the increasing complexity of machine tools, it involves deeper technical challenges and innovation needs. For example, the emergence of new technologies, such as high-speed machining, multi-axis linkage, composite processing and so on, poses higher requirements for the performance, accuracy, stability and so on of machine tools. This requires in-depth research and innovation from many fields, such as material science, control theory, robot technology and so on. This shows that the practical nature of the machine tool gradually goes beyond the original technical category, showing a kind of comprehensiveness and complexity, which requires a more profound and comprehensive philosophical reflection. Especially in recent years, China has increased its investment in infrastructure and construction or waiting for the construction of machine manufacturing plants in major factories. In order to successfully complete these huge machine tool projects, it is necessary to comprehensively consider many factors and their interrelationships, such as technology, capital, economic benefits, resources, ecology and so on. The course of machine tool technology is one of the core courses of mechanical engineering, manufacturing engineering and other related majors, which trains students to master the principle, operation and maintenance technology of machine tools. By learning machine tool technology, students can master the basic principles and

techniques of mechanical processing, cultivate practical ability and the ability to solve practical problems, and lay a solid foundation for future work in fields related to mechanical engineering. Therefore, in the teaching of machine tool technology, digging deep into the ideological and political elements of the course and educating students in dialectical materialism are important ways to give full play to the course's function of moral education.

2 Dialectics in machine tool technology

As an important part of Marxist philosophy, materialist dialectics includes three laws: unity of opposites, quality change, and negation of negation. The core idea of materialist dialectics is closely related to the teaching of machine tools. In machine tool teaching, we can also use the three laws of materialist dialectics to guide learning and understanding. When learning machine tool operation, we often encounter various opposing concepts or elements, such as speed and precision, efficiency and quality, and so on. By understanding the law of unity of opposites, we can recognize the interdependence and unity between these opposing factors. In the actual operation, parameters and performance indexes of machine tools often do not exist in isolation, but influence and restrict each other. Through a deeper understanding of the law of quality change, we can better adjust various parameters. The law of negation of negation also has guiding significance in machine tool teaching. In the process of learning and practice, we often encounter failures and setbacks, but this does not mean the end, but a new starting point. In a word, learning dialectics can help students learn the essence and law of machine tool operation more deeply.

2.1 Unity of opposites in machine tools

Every machine tool first reflects the unity of opposites of matter and energy. In the process of machining, machine tools need to convert raw materials into final products, in which material processing and energy transfer are involved. For example, when a machine tool cuts a workpiece, it takes energy to cut off the raw materials and convert the energy into cutting heat and remaining waste. In this process, the unity of opposites of matter and energy is reflected in the fact that when the machine tool completes the processing task, the mutual transformation of matter and energy is inevitable. Secondly, there is a contradiction of unity of opposites between accuracy and efficiency. When working, machine tools need to pursue high-precision machining to ensure the quality and accuracy of products. However, high-precision machining is usually accompanied by low machining efficiency, because higher precision requirements mean a slower and more cautious machining process. In this contradiction, machine tools need to find a balance between accuracy and efficiency in order to meet the dual needs of product quality and production efficiency.

At the same time, the operation of machine tools also involves the unity of opposites of man-machine cooperation. Although modern CNC machine tools have the characteristics of automation and intelligence, they still need human participation and monitoring. Human operators need to set processing parameters, monitor the running status of machine tools, and deal with abnormal situations in time. The unity of opposites of man-machine cooperation shows that while automation is available, human wisdom and skills are still the key factors to ensure the normal operation and efficient machining of machine tools. In the whole life cycle of machine tool operation, there are all kinds of contradictions from design and manufacture to use and maintenance. For example, the contradiction between structural stiffness and quality needs to be considered in the design stage, the contradiction between cost and quality needs to be balanced in the manufacturing stage, and the contradiction between precision and speed should be considered in the use stage. These contradictions are intertwined in the process of machine tool operation, and influence and restrict each other, but promote the continuous development of machine tool technology through interaction.

2.2 Quality change in machine tools

The law of quality change plays an important guiding role in machine tool teaching. Machine tool operators

need to strictly control and manage the quality of workpieces to ensure that the products meet the expected standards. This requires operators to pay enough attention to the accumulation of quantity. Only through long-term practice and experience accumulation can they accurately perceive the small changes in workpiece quality and take corresponding adjustment measures. In machine tool teaching, in addition to imparting operational skills and theoretical knowledge, it is also necessary to pay attention to the quality of workpieces and cultivate students' sensitivity and ability to cope with quality changes in order to improve production efficiency and product quality. We should not rush for quick success and instant benefits, but should carefully deal with negative factors and take preventive measures; at the same time, people should skillfully grasp the opportunity according to the development process of things, so as to promote the profound evolution of things from quantity changes to quality changes. The understanding and following of this law will help to guide people to understand the evolution process of things more clearly, deal with changes cautiously, and promote more profound quality changes.

When the machine tool operates, it embodies the concept of quality change in philosophy, which is a part of the philosophical thought of dialectical materialism, which emphasizes the mutual transformation of internal contradictions and the process of quality change. In the operation of machine tools, the quality change is reflected in many aspects, including material quality, machining quality, design quality and so on. First of all, the quality change reflected in the operation of machine tools can be considered from the perspective of material quality. In the process of processing, machine tools need to deal with a variety of materials, including metals, plastics, ceramics and so on. The quality of these raw materials directly affects the quality of the final product. However, after the cutting and grinding of machine tools, the quality of raw materials will change. The internal structure of the material may have plastic deformation, residual stress and so on, which have a direct impact on the quality of the final product. Secondly, the quality change in machine tool operation is also reflected in the machining process. Machine tools transform raw materials into final products through continuous cutting, grinding, forging and other processing operations. In this process, the size, shape, surface finish and other quality characteristics of products are changing. This change is affected not only by the quality of raw materials, but also by the accuracy of the machine tool itself, tool wear, lubrication state and other factors, forming a complex system with interchangeable quality.

From the perspective of design, the quality of the machine tool also changes in the operating process. Design quality involves many aspects such as structural design, material selection, process design and so on. In the process of machine tool operation, quality changes of the design through the interaction with the manufacturing and use stages. In order to improve the machining efficiency, the design may sacrifice certain stiffness, which is the embodiment of the design quality in the interchange. The change of design quality has a direct impact on the performance and stability of machine tools. The quality change is also reflected in the operation and maintenance of machine tools. With the long-term use of machine tools, the wear of parts and the decline of accuracy will gradually appear. In order to maintain the stability and accuracy of the machine tool, regular maintenance and overhaul are required. During this process, the quality change of machine tools in turn affects the long-term performance and life of machine tools.

Mao Zedong once said, "All quality appears in a certain quantitative form", which can be interpreted as the quantity change in the machining process of machine tools. In machine tool operation, parameters such as rotational speed, feed speed, cutting depth and so on are the embodiment of quantity change. The adjustment of these quantity changes directly affects the quality of the machining results, such as surface roughness, dimensional accuracy and so on. "No quantity means no quality, and vice versa" can be interpreted as the close relationship between quality change and quantity change. In machine tool machining, the quality change means that the quality

of the machining result can be improved by reasonably adjusting the quantity change parameters, such as machining speed, tool cutting depth and so on. At the same time, if the quantity change parameters are not set properly, it will affect the quality change and lead to the decline of processing quality. Under the premise of quality, the process of quality change should be strictly carried out to ensure that the advantages of management can be brought into full play and at the same time stimulate all individual subjective initiative. This philosophical principle is very important for the effective operation of the machine tool, and provides a theoretical support for achieving excellent management and maximizing human initiative in order to better meet the needs of modern industry for high-quality and efficient processing. The understanding of the quality change in machine tools also implies that when dealing with complex systems, one side of things cannot be viewed simply: some machine tools may decrease their accuracy and stability due to wear or deformation of parts after running for a long time. As a result, the machining accuracy does not meet the requirements. After several years of application, the machining accuracy of a CNC milling machine decreases significantly due to the wear of the guideway and the failure of the main bearing, which leads to the instability of product quality and brings a series of quality and safety problems to the manufacturing of high-speed railway. This situation shows "an old cow pulling a rickshaw", that is, only paying attention to quality while neglecting quantity reflects two extreme mistakes in the category of metaphysics. In this phenomenon, quality and quantity are mistakenly placed in an opposite position, while the dialectical relationship between them is ignored, which leads to systematic problems and instability. This metaphysical misconception hinders the overall understanding and scientific management of machine tool operation. The change of quality should be viewed dialectically, and the contradictory relationship of unity of opposites should be fully understood and utilized so as to promote the continuous progress of machine tool technology.

Generally speaking, when the machine tool operates, it embodies the quality change in philosophy. That is to say, in the life cycle of machine tools, the quality of each stage interacts with and transforms each other. This kind of mutual variation is not linear, but a complex nonlinear system, which is affected by many factors. Understanding and grasping the law of quality change is helpful to optimize machine tool design, improve production process and prolong equipment life.

3 Negation of negation in machine tools

The law of negation of negation reveals the direction and way of the development of things. In machine tool teaching, the law of negation of negation can be associated with the machining process of workpieces. In the machining process, the workpiece has experienced a series of processing steps, such as rough machining, finishing, surface treatment, etc., each step may have problems or need to be improved. These problems and improvements can be seen as a negation of the artifact, that is, there are some imperfections or aspects that need to be improved. However, through the understanding of the problems and the implementation of improvement measures, the workpiece can be continuously improved and developed, and finally reach the state of negation of negation, that is, to achieve higher machining accuracy and quality. In this process, the negative view of metaphysics can be understood as the intervention of external forces in the machining process, which may be caused by improper operation or setting of machine tool parameters. The dialectical view of negation can be understood as the inherent problems and contradictions of the workpiece, and the self-development and improvement of the workpiece can be realized through the understanding and improvement of these problems in the continuous processing process. Therefore, through the understanding of the law of negation of negation, students can be guided to pay attention to the understanding and solution of problems in machine tool teaching, so as to continuously improve the level of processing technology and realize the self-development and improvement of the workpiece machining process. The whole development process of machine tool can be regarded as a process of negation of

negation, which represents the complex and dynamic development process of self-negation, sublation, development and perfection of machine tools in the movement of internal contradiction.

First of all, the negation of negation in machine tool operation is reflected in the continuous progress and innovation of technology. With the development of science and technology, machine tools continue to innovate in design, control, materials and so on, surpassing the previous technical level. This kind of technological innovation is not only a negation of the previous technology, but also a negation of the negation, that is, it inherits and surpasses the advantages of the old technology in the new technology. For example, the introduction of numerical control technology negates the traditional manual operation, and improves the machining accuracy and efficiency. And then, with the development of numerical control technology, more intelligent and flexible machine tools appear, negating the previous limitations of numerical control technology. Secondly, the negation of negation in machine tool operation is reflected in the continuous evolution of the mode of production and technology. The evolution of machine tools as production tools has experienced a process from manual to mechanical, and then to numerical control and intelligence. Each evolution is not only the negation of the previous mode of production, but also the negation of the previous negation in the new mode of production. For example, the introduction of traditional manual lathes to mechanical lathes negates the inefficiency and instability of manual operation, and then with the emergence of CNC lathes, negates some restrictions of mechanical lathes and further improves the degree of automation of production. In the process of machine tool operation, changes of economic conditions and market demand also promote the negation of machine tool technology. The market demand for product quality, efficiency and cost is increasing, which forces machine tool manufacturers to meet market demand through technological innovation and performance improvement. Each round of technological innovation and performance improvement is not only a negation of the previous technology and performance, but also a re-negation of this negation, which provides a driving force for the long-term development of machine tool technology.

In addition, the negation of negation in machine tool operation is also shown as the concern for environmental friendliness and sustainability. In modern society, requirements for resource utilization efficiency and environmental protection are increasing day by day, which drives the machine tool manufacturing industry to pay attention to green production and sustainable development. Machine tool manufacturers innovate in material selection, energy utilization and waste disposal, which negates the traditional waste of resources and environmental pollution, and promotes the machine tool industry to develop in a more environmentally friendly and sustainable direction. The negation of negation in machine tool operation is a dynamic and spiral development process. Through the continuous negation and re-negation of technology, mode of production, market demand and environmental concerns, machine tools continue to advance to a higher stage. The embodiment of this philosophical concept lies not only in the aspect of technological innovation, but also in the response of the machine tool manufacturing industry to the society, environment and so on.

4 Conclusion

We apply some viewpoints and methods of materialist dialectics to machine tool teaching and successfully resolve teaching difficulties. There are many factors affecting the machine tool, which requires us to analyze the technology from a dialectical point of view, so that we can abandon the one-sidedness, extremity, rigid thinking and so on, and improve the production efficiency of the machine tool. Only in this way can we fully and correctly understand the relationship between human beings and science and technology, use science and technology as a tool to protect and develop the external world we rely on, and create more scientific and technological achievements beneficial to human production and life. In this process, dialectical thinking is not only a thinking tool, but also a source of wisdom to guide practice, transcend narrow ideas and promote the development of science and technology.

It emphasizes a comprehensive and profound analysis of the contradictions and opposites in the development of things in order to understand the nature of things and promote the development of things. In machine tool teaching, we often encounter various knowledge difficulties and contradictions, such as the disconnection between theory and practice, students' difficulties in understanding abstract concepts, and so on. If teachers can introduce the principle of materialist dialectics into teaching practice, they can deeply analyze the nature of contradictions and find out ways to solve problems through dialectical thinking.

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