Discussion on the Cultivation of Mechanical Talents in Applied Colleges Under the Background of “Made in China 2025” + “New Engineering”

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Abstract. Under the background of innovation-driven development and "made in China 2025", the education sectors put forward the "new engineering" to adapt to the new changes in the world economy. Therefore, it was of great practical and strategic significance to cultivate engineering talents with strong scientific foundation, strong engineering ability and high comprehensive quality to support the vigorous development of new economy featuring new technologies, new business forms, new industries and new models. Based on the teaching work of mechanical majors in local private institutions, this paper explores a new model for training talents under the background of "Made in China 2025" and "New Engineering" by reforming the curriculum structure system, reforming the teaching methods of courses, and strengthening the evaluation and construction of students’ academic achievements.

Preface

"Made in China 2025" put forward the basic principle of "innovation-driven, quality-oriented, green development, structural optimization, and talent oriented", and adhered to "market-led, government-guided, and based on the current and long-term perspective." The basic principles of overall advancement, key breakthroughs, independent development, openness and cooperation are the action programs of the Chinese government for the first decade of implementing the strategy of manufacturing power[1]. The construction of "New Engineering" is a new revolution in the field of engineering education in response to the new needs of engineering talents in a series of powerful countries such as "Made in China 2025", "Artificial Intelligence" and "Belt and Road" proposed by the country[2]. Since the "New Engineering Section" was formally proposed in 2016, in 2017, the "Circular of the Department of Higher Education of the Ministry of Education on the Conduct of Research and Practice of" New Engineering Section "summarized the" New Engineering Section "as` five new". That is, "the new concept of engineering education, the new structure of discipline majors, the new model of talent training, the new quality of education and teaching, and the new system of classification and development"[3]. From the "Fudan Consensus" to the "Great Action" to the "Beijing Guide" in just six months, the construction of the "New Engineering Section" has been systematized from concept to connotation, action, and direction. The construction of the new engineering department has also become the guiding principle of the new revolution of higher engineering education in the new era in China. It is another important milestone for higher engineering education in China following the implementation of the "Excellent Engineer Education Training Plan" and becoming a full member of the "Washington Agreement."

Whether it is "Made in China 2025" or "New Engineering", it is necessary to cultivate engineering and scientific personnel with a strong scientific foundation, strong engineering capabilities, and high overall quality. It is of great practical and strategic significance to support the new economic development characterized by new technologies, new forms of business, new industries and new models. In order to promote "Made in China 2025", the Ministry of Education promulgated the "Guidelines for the Development of Manufacturing Talent Planning" at the end of
2016: "Encourage and support higher education institutions to innovate the content, goals and models of engineering education. Strengthen the development of engineering technology disciplines and specialties such as electronic information, machinery, materials, marine engineering, and bioengineering that support the country's innovative development strategy."\[14-6\]. Based on the needs of the society in the era of intelligence and the modernization of our country, the mechanical specialty is undoubtedly the most important part of the personnel training in engineering colleges and universities. Taking the training of mechanical talents as an example, this paper explores how the application-oriented undergraduate colleges and universities combine their own levels of running and positioning talents training goals to establish new paths for innovative talents training patterns that distinguish them from the superior engineering colleges and higher vocational colleges. In response to the new era of society's demand for "new engineering" talents.

In 2014, the specialty of mechanical manufacturing and automation in our school was included in the "Strategic Emerging (Pillar) Industrial Talent Training Program for Ordinary Colleges and Universities" in Hubei Province and the "Comprehensive Reform Pilot Program for Ordinary Undergraduate Colleges and Universities" in Hubei Province. In 2017, he successfully applied for the characteristic professional construction project of the "Jingchu Outstanding Engineer Collaborative Education Program" in Hubei Province. In the course of the professional construction of the "New Engineering Section", we will closely focus on the fundamental tasks of the Lide Shuren, further promote the establishment of strategic alliances with industry enterprises, research institutes, and practical departments, and make solid progress in the training model of high-quality applied talents. Proactive exploration and practice in optimizing the content of the curriculum system, innovating teaching methods, and strengthening practical teaching links have achieved remarkable results.

The Innovation Point of Specialty Construction

Reform of the Curriculum Structure

Curriculum is the basic basis of educational and teaching activities, is the basic guarantee for achieving educational goals, and is the intermediary of all school activities[7]. The structure determines the function. The curriculum construction of the "New Engineering" major must first work hard on reforming the curriculum structure. University education is both quality education and professional education. Quality education is the foundation of training "new engineering" talents with "craftsman spirit", and professional education is the guarantee of training "new engineering" talents with professional knowledge and professional skills. Therefore, the curriculum structure system should embody cultural attributes, social attributes, and humanistic attributes. On the basis of the "cross-discipline and curriculum reform", we will follow the "student-centered" education philosophy, base ourselves on the "people-oriented" education philosophy, focus on the all-round development of students, and attach importance to and effectively deal with the issues of common and unique characteristics of students. Provide students with more free choice and development space. We will build a new system of theoretical courses and practical teaching, focus on strengthening practical ability and innovative quality, and develop more high-quality practical courses, internationalized courses, and cross-curricular courses for interdisciplinary majors, reflecting the special professional orientation of "smart manufacturing and three-dimensional digital technology". The distinctive features of "Industrial Robots" and "3D Printing" in the course structure system. Focusing on the goal of professional training, we will strengthen cooperation between schools and enterprises, promote innovative models of professional education such as embedded courses and job training, and introduce enterprise engineering practice courses through short-term training courses or professional co-construction models, so as to closely adhere to the core competencies of the "New Engineering Section". Highlight the training of engineering practice ability. Our school's mechanical design and manufacturing and its automation majors have set up a total of 7 general courses, academic platform courses, professional basic courses, professional core courses, professional orientation courses, centralized practical teaching links, and personalized courses. The specialty orientation course system is shown in Table 1.
Table 1. Course system for specialty orientation.

<table>
<thead>
<tr>
<th>Course Category</th>
<th>Intelligent Manufacturing and 3D Digital Technology</th>
<th>Industrial Robot Direction</th>
<th>3D Printing</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Studies</td>
<td>the same</td>
<td>the same</td>
<td>the same</td>
</tr>
<tr>
<td>Subjects Platform</td>
<td>the same</td>
<td>the same</td>
<td>the same</td>
</tr>
<tr>
<td>Basic Course</td>
<td>AutoCAD Two-dimensional Software</td>
<td>Industrial Robot Technology Basic</td>
<td>3D Printing Technology Introduction</td>
</tr>
<tr>
<td>Professional core course</td>
<td>mechanical principles and design, mechanical manufacturing technology foundation, mechanical and electrical transmission and control</td>
<td>industrial robot mechanical system integration design</td>
<td>three-dimensional measurement technology and collection data processing, 3D equipment and technology and modeling design</td>
</tr>
<tr>
<td>professional orientation courses</td>
<td>Three-dimensional digital software (ProE, Solidworks, Inventor), CNC technology and programming, die design and manufacturing, automobile principle and structure</td>
<td>On-site programming and debugging of industrial robots, offline programming and simulation of industrial robots, electrical control and PLC</td>
<td>3D printing software technology, 3D printing materials and product design, 3D printing and creation, 3D printing post-processing and application</td>
</tr>
<tr>
<td>Personalized course</td>
<td>mechanical finite element analysis (Ansys), optional industrial robot technology, 3D printing technology, etc</td>
<td>Industrial Robot Project Design and Management, Industrial Robot System Integration, Industrial Robot Maintenance and Maintenance</td>
<td>CAD/CAM Application, Photocuring 3D Printing Technology, 3D Equipment Maintenance and Maintenance</td>
</tr>
</tbody>
</table>

The "new engineering" innovative and applied talents training in the mechanical category will be "industry-oriented" to introduce social outstanding enterprises into universities, use the advantages of schools and enterprises, jointly form a training base for talents training, and establish a collaborative training platform for schools and enterprises(Figure 1). At present, the school and enterprise cooperation of the Department of Machinery of our school has jointly established four on-campus practical teaching centers: the Smart Manufacturing 3D Digital Design Center, the Industrial Robot Center, the 3D Printing Center, and the Innovation and Entrepreneurship Center. The four characteristic centers complement each other and develop together. Joint training of "new engineering" talents, in line with the market. The practice platform for collaborative parenting of schools and enterprises is shown in Figure 1.

The first class is the basis of the "new engineering" innovative applied talents training, while the second class is the cultivation of personality and specialty. Basic and characteristics are equally important. The main participants in talent training are teachers and students. The first class is to learn the theory of books in the classroom, to do various verification, comprehensive, and innovative experiments in the laboratory, and the second class is for students to study and study under the guidance of the teacher, or to form a team spontaneously to study and study. The professional knowledge learned in the first class. Using the spare time and the processing and production places provided by the school, through the careful observation of production and life practices, some forward-looking, practical, innovative professional areas are solved. By linking theory with practice, we can improve students ability to practice, innovate and design, apply theory to solve practical problems, and improve their ability to think independently and learn independently. Cultivate "new engineering" applied innovation talents that meet the needs of society and enterprises.
Talent training is the first academic responsibility of teachers. The teacher's "teaching" is for the student's "learning". Students have education after learning, and there is no education without learning. The success or failure of teaching depends to a large extent on whether teachers can properly choose teaching methods. The clarity, specificity, basis, effectiveness and credibility of knowledge depend on the effective use of teaching methods. Then, in teaching, teachers should first understand the students, to consciously observe the students into the category of duties, spend time with students to communicate, understand the students' learning situation, explore the law of learning. Constructivist learning theory holds that the learning process is a process in which the learner actively constructs knowledge, and the learning activity is the meaning of the student actively generating information through interaction with the outside world based on the original knowledge and experience. Therefore, the author believes that teachers should try their best to explore from the following aspects in teaching. The first is to construct the situation. Education is that one tree shakes another tree, one cloud pushes another cloud, and one soul strikes another soul; Good situation can make students happy, active thinking to enhance the efficiency of learning. The second is to stimulate interest. Interest is the best teacher. Teachers must stimulate students' interest by expounding meaning, activating knowledge, and being close to students' lives. The third is to promote thinking. "Learning without thinking is useless, thinking without learning is difficult." Confucius explained the relationship between learning and thinking thousands of years ago. Thought and knowledge belong to the category of consciousness, but thought includes the self. It contains the relationship between the self and the surrounding environment. Only after thinking can you form your own thoughts.

In response to the goal of "new engineering" personnel training, teachers of mechanical manufacturing and automation in our school actively reformed teaching methods, adopted practice-driven or research-driven teaching methods according to the characteristics of different courses, reduced the burden on students' academic work, and cultivated students' interests. We will fully mobilize students' initiative, actively guide them to engage in scientific and technological innovation activities as early as possible, participate in teacher research on subjects as early as possible, and conduct extensive discussion and participatory teaching based on questions, projects, and cases. For example, Project 1-Project 4 of the three-dimensional digital series practice course adopts a project-based CDIO teaching model, combining course learning with Xiangmu-xueqi, and deeply embodies the characteristics of professional engineering. The mechanical principle course adopts a hybrid teaching reform based on "flipping classroom" to guide students to study independently and construct knowledge.
Reconstructing Student Academic Performance Evaluation System

The formative evaluation of students' academic performance is based on students' growth and development. In the evaluation process, students' performance in normal learning activities, their ability to solve problems in the discussion process, and their rationalization suggestions for completing the goals are all used as the basis for evaluating students. At the same time pay attention to the use of self-evaluation, mutual evaluation. It not only pays attention to the students' learning results, but also pays attention to the students' personality characteristics in the learning process, so as to effectively promote the healthy development of students' personality.

When implementing formative evaluation, we first reform the examination system. It is mainly to reform the examination content and examination methods. For the content of the examination, the main problem in the previous mechanical design and manufacturing and automation professional examinations was that the content of the examination was single, and most of them remained on the examination of students' mastery of knowledge. The content lacked comprehensiveness and research. In view of this problem, the major has reformed the content of the examination, reduced the assessment of memorizing knowledge, and increased the assessment of innovative applied knowledge. The reformed knowledge of memorization does not exceed 10 %, understanding knowledge does not exceed 20 %, and applied innovative knowledge accounts for more than 70 %. For the examination method, the profession abolished the "one test conclusion", that is, the practice of evaluating students' learning effects with a one-time examination of the final exam, and combining the final examination with the usual assessment. The final results of the students are: 5 % of normal attendance, 15 % of classroom tests, 20 % of assignments, 20 % of student PPT presentations, and 40 % of final exams. Fully reflect the emphasis on process teaching.

Summary

Against the backdrop of the country's implementation of major development strategies such as innovation-driven development and "Made in China 2025", the "New Engineering Section" focuses on the characteristics of the times such as the Internet revolution, the development of new technologies, and the upgrading of manufacturing industries. To develop students' core abilities -- the ability to learn and quickly learn new things, to promote the intersection of existing engineering, the intersection of engineering and other disciplines, to promote cross-disciplinary integration of disciplines, and to cultivate talents with high overall quality. Let students study in a broader academic perspective, so that the chain of innovation can be fully extended. This is a change in the concept and paradigm brought about by the "new engineering". Our school's mechanical design and manufacturing and automation majors have shifted from subject orientation to industry demand orientation. Through reforming the curriculum structure system and curriculum teaching methods, we have strengthened the evaluation and construction of students' academic achievements, and further promoted cooperation in production and learning, integration of production and education, and cooperation in science and education. Promote the close integration of talent training with industry needs. With intelligent manufacturing as the carrier, the curriculum boundary is redesigned, and the adaptation service is turned to support and guidance, and applied innovation talents are cultivated.

References


