

Research on Cultivation Mode of Innovation Ability of Mechanical Engineering Students

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Abstract: With the gradual advancement of new engineering construction, the teaching of mechanical majors in Chinese universities pays more and more attention to cultivating graduate students' innovative abilities. As high-level talents, the promotion of graduate students' innovative ability is of great practical significance for promoting the high-quality development of our country's equipment manufacturing industry. Although the number of graduate student enrollment in the country shows a trend of expanding the scale and increasing the number of enrollment, there are also problems that the cultivation of graduate student innovation ability is difficult to effectively meet the current social demand. Based on this, this paper focuses on the existing problems in the cultivation of innovation ability of mechanical graduate students at the present stage, and elaborates how to optimize the talent training mode of colleges and universities, in order to improve the innovation ability of graduate students and improve the graduate training system.

Keywords: Universities; Mechanical graduate students; Innovation ability training

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1. Introduction

At present, new technologies have been widely applied to the manufacturing industry, which has undergone tremendous changes. This requires the teaching of machinery major in colleges and universities to actively innovate the training mode of talents. For machinery majors in colleges and universities, in order to adapt to the new requirements of the development of the era for personnel training, universities should strengthen the cross-integration of professional teaching with new technologies and new materials, and then strengthen the cultivation of graduate students' innovative consciousness, innovative ability and innovative practical ability. However, as the main force of training innovative and applied graduate students, there are still some problems in the talent training system of colleges and universities. Therefore, in the new era, it is urgent to improve the quality of the training mode of innovative ability of graduate students in universities.

2. The problems in the training mode of the innovation ability of mechanical graduate students

2.1. The training mode has not kept pace with the era

At present, the teaching mode of mechanical major theory courses should be limited to the teacher's single teaching. This is mainly because there are few hours of theoretical courses for postgraduates, and teachers seldom innovate and reform the teaching mode. As a result, the teaching depth and teaching breadth of theoretical courses make it difficult to meet the practical needs of cultivating graduate students' innovation abilities. If the theoretical content taught is too profound, and cannot give students enough time to think and digest, it will seriously affect their subjective initiative and weaken the teaching effect ^[1]. On the other hand, it is difficult for students to gain anything from a class with shallow teaching content. In addition, practical courses are also an important part of cultivating graduate students' innovation ability. However, at present, the practical courses of mechanical majors in some colleges and universities are limited to the campus, and few rely on school-enterprise cooperation to carry out practical talent training mode based on "on-the-job internship."

2.2. School-enterprise cooperation lacks depth and breadth

The lack of depth and breadth of school-enterprise cooperation is mainly reflected in the lack of off-campus practice and training bases for cultivating graduate students' practical and innovative ability, and the low degree of school-enterprise joint training. First of all, in the construction of off-campus training bases, colleges, and universities have not invested a lot of spirit, and lack corresponding research funds. Secondly, although the universities and enterprises have reached a certain degree of cooperation on personnel training, technical personnel at the enterprise level have not been widely involved in the formulation of graduate training programs and the implementation of curriculum systems, thus limiting the improvement of graduate students' innovation ability ^[2]. At the same time, the shallow level of cooperation between universities and enterprises causes the cultivation of innovation ability of mechanical graduate students to lag behind the development of industrial technology, resulting in the student's research projects being divorced from the real needs of the industry.

2. The strategy of optimizing the cultivation mode of innovation ability of college mechanical graduate students

2.1. Build the integrated curriculum system of "production, university, research and innovation"

The cultivation of innovation ability of mechanical graduate students in colleges and universities focuses on two aspects: theory and practice. The innovation concept requires colleges and universities to uphold the educational principle of "cultivating talents by virtue" in the process of innovating the training mode. It should not only guide postgraduates to pay attention to theoretical science in life but also introduce the current development status of the machinery manufacturing industry and the practical problems it faces in the transformation and upgrading of industrial structure into the course teaching to promote the deep integration of theoretical teaching and practical teaching as well as "industry-university-research-innovation" interoperable and integrated curriculum system ^[3]. In this way, it can lead the graduate students to focus on the real problems in practical engineering, which can promote the integration of theory and practice, through multi-angle analysis and verification, and apply the knowledge to solve practical problems. This is an effective way to

train graduate students' innovative thinking and innovative ability.

At the same time, the cultivation of the innovation ability of mechanical graduate students depends on the innovation of teaching methods and the teaching environment. Therefore, in the practice of building the integrated curriculum system of "production, university, research and innovation," colleges and universities should take the social demand as the guide, optimize the curriculum standards and enrich the curriculum content. With the goal of cultivating innovation ability, the integration of teaching, practice, scientific research and innovation should be promoted.

First of all, based on research-based teaching, innovative learning and the transformation of scientific research results, the standards of mechanical postgraduate courses are formulated^[4]. This is the concrete carrier to implement the cultivation of innovative talents, focusing on whether students can learn knowledge after completing the course study and whether they can flexibly apply the knowledge to actual production and work, which is directly related to the quality of the cultivation of innovative ability of graduate students. In this regard, colleges and universities should regularly hold seminars with technical personnel of enterprises to understand the technical status quo of the production line of the machinery manufacturing industry, the development direction of future technologies, and the application of cutting-edge technologies. In this way, the technical standards of the industry and the objective requirements of post-vocational ability are integrated into the curriculum standards of "industry-university-research and innovation," which can not only fully investigate the topic selection of graduate students, but also achieve the same frequency resonance between the training of graduate students' innovation ability and the development of the industry.

Secondly, the school and enterprise jointly develop cooperative courses. Under the mode of school-enterprise cooperation, "industry-university-research and innovation" interoperable and integrated courses no longer set specific course content based on disciplines, but take work tasks as a reference point, based on the integrated teaching mode of "teaching, learning, doing and evaluation," and take work projects as the course learning content^[5]. The development of project courses allows students to experience the real and complete workflow, gives students the space for innovation, and enables students to carry out correct innovation in specific project practices.

2.2. Create a "research - competition" integration enabling mechanism

Mechanical discipline is universal and interdisciplinary and plays a strong role as a basic discipline in scientific research projects and engineering industries^[6]. Therefore, from the two dimensions of scientific research innovation and technological research, the cultivation of graduate students' innovation ability is helpful to promote the high-quality transformation of scientific research results and effectively improve the innovative practical ability of graduate students. Specifically, colleges and universities can integrate scientific research topics and discipline competitions into the teaching and training system of graduate students, and create a "research-competition" integration enabling mechanism to promote graduate students to transform laboratory results into practical applications in discipline competitions and activate the internal driving force of graduate research and innovation^[7].

First, determine the scientific research project. The improvement of the innovation ability of mechanical graduate students driven by scientific research projects is mainly divided into three stages.

(1) The pre-research stage

In this stage, mechanical graduate students need to track the domestic and foreign trends and research progress of related technologies and related projects, and then find and propose problems in the pre-research

stage. In this process, the innovation ability of graduate students is cultivated mainly from the two aspects of the overall analysis of literature and the discovery and question raising. Guiding graduate students to do a good job in literature review and cultivating their literature retrieval ability, literature reading and thinking ability in various aspects and dimensions can enable them to have a deep understanding of research problems and a comprehensive understanding of research methods in subsequent project research to effectively guarantee the innovation of project outcomes^[8]. At the same time, guiding graduate students to find and propose problems with research value and urgent solutions in the process of searching academic research papers and patents will help improve the sensitivity of graduate students to the cutting-edge technical knowledge of the machinery industry and pave the way for their subsequent academic innovation and scientific research innovation.

(2) The project initiation stage.

In this stage, mainly around the key scientific issues, the scientific research process is written into the project application.

(3) The project implementation stage.

This stage is the method of constructing and verifying the theoretical model of the graduate students.

Secondly, participate in discipline competitions. Encourage graduate students to actively participate in discipline competitions according to their own research direction. To stand out in discipline competitions, graduate students need to integrate their research projects and sublimate their theories. Therefore, it is necessary to write a high-quality project report^[9]. Moreover, writing a project report requires postgraduates to state the feasibility, practicability and innovation of the research project in a concise way, which is an effective way to cultivate their innovation ability. To this end, postgraduates should pay extensive attention to the problems that need to be solved in the machinery industry, and transform these problems into scientific problems and explore innovative and applicable research methods in specific practice to highlight their scientific research advantages in the defense link. Realizing the integration training of scientific research projects and discipline competitions is of great value to activate the consciousness of scientific research innovation of graduate students and improve their innovation ability^[10].

2.3. Strengthen curriculum ideological and political construction

Empowered by modern science and technology, fundamental changes have taken place in the machinery industry. This requires mechanical talents to have a deep understanding of cutting-edge technology and have rich practical experience, and should have the ability and quality of scientific and technological development, scientific research and innovation. The construction of curriculum ideology and politics plays a significant educational advantage in cultivating the innovation and practice ability of college mechanical graduate students and developing a powerful country in science and technology. Therefore, promoting the coordinated development of mechanical teaching and ideological and political education will help fully integrate the new demands of science and technology and manufacturing powers for cultivating innovative talents into the training system of graduate students, and effectively play the role of innovative talents in pooling wisdom in scientific research and innovation^[11].

In this regard, colleges and universities should take the craftsman spirit and innovative practical ability as the core, and actively build a high-quality personnel training system to vigorously promote the ideological and political construction of curriculum while retaining the advantages of traditional personnel training mode^[12]. In order to give full play to the educational value of ideological and political cases in the practice of cultivating graduate students' innovative ability. Taking the advanced internal combustion engine as an

example, in the process of compiling ideological and political case database, college teachers should design detailed and complete case descriptions, case handouts, case text and so on. For example, by showing the development cases of internal combustion engine and automobile industry in China, activate the consciousness of self-strengthening through science and technology of graduate students, and cultivate dialectical thinking of graduate students by introducing cases with the characteristics of internal combustion engine and other power devices. By integrating the ideological and political elements such as strong science and technology into the training of graduate students' innovation ability, as well as creating high-quality mechanical ideological and political demonstration courses, the guiding function of ideological and political education can be fully given play to, and the initiative of graduate students to serve the country and participate in national construction can be activated, so as to change the psychology of some graduate students "pursuing degrees rather than learning" and make them clear their ideal goals ^[13].

2.4. Deepen school-enterprise cooperation in education

Relying on the integration of production and education and the cooperation between schools and enterprises, the innovative practical ability of graduate students can be expanded to the real production environment, and the innovative consciousness and innovative thinking of graduate students can be activated by practical problems and challenges ^[14]. First of all, specific plans and programs should be formulated to cultivate graduate students' innovative abilities. The practical courses under the mode of school-enterprise cooperation aim to enable students to use theoretical knowledge in practice to improve their practical innovation ability and professional quality. Therefore, when designing talent training plans and programs, colleges and universities should increase the proportion of off-campus practice and training, encourage postgraduates to participate in real engineering projects during the practice and training, and have in-depth and extensive communication with enterprise planners. This can enable students to learn and master practical skills and engineering application technology at the same time, fully understand the employment prospects and career development direction of mechanical majors, and then define their career planning.

Secondly, the establishment of the double tutor system can deepen the cooperation between school and enterprise education. Although at this stage, the joint training mechanism built by the school and enterprise cannot fully realize the "on-the-job internship," the school and enterprise can take the project output as the orientation so that students can realize the deep combination of theory and practice under the systematic guidance of the school and enterprise double tutors. On the one hand, the enterprise tutors are responsible for guiding and supervising the writing of graduate dissertations and research topics. On the other hand, the school supervisor is responsible for guiding the project research, as well as the dissertation proposal, assessment, defense, and other work. In this way, the management and service mechanism of cultivating graduate students' innovative ability can effectively promote the divergence of graduate students' innovative thinking and make them adopt new methods to carry out project research. The implementation of the double tutor system can improve the training quality of graduate students in colleges and universities and also meet the actual needs ^[15] of enterprises for innovative talents.

3. Conclusion

To sum up, with the deepening of the construction of new engineering, innovation ability has become the core of mechanical talents training in colleges and universities. To this end, intending to cultivate innovative

practical ability and project research as the starting point, college mechanical majors continue to explore multiple models of cultivating graduate students' innovative ability by constructing the integrated curriculum system of "industry-university-research and innovation," creating the integrated enabling mechanism of "scientific research-competition," and strengthen curriculum ideological and political construction. Moreover, optimizing the training mechanism of graduate students' innovation ability based on "school-enterprise collaboration" is helpful to effectively improve students' ability to deal with practical problems and promote their sustainable development.

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