

Inquiry Rationality of Cultivating New Engineering Talents Based on Academic Teaching

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Abstract: Cultivating new engineering talents with inquiry rationality should be the focus of new engineering construction. The profound connotation of the inquiry rationality of new engineering talents in engineering ontology, epistemology, methodology and axiology play an important role in matching and leading the reform in the future engineering field and promoting the development of the new economy of our country. The inquiry rationality of new engineering talents should be trained by the academic teaching system. Therefore, it is necessary to clarify our mind on the selection, transformation and internalization of university academic resources. Also, a good operation mechanism is needed to establish covering many aspects, including the layout of new engineering majors, the renewal of knowledge system and the construction of new teaching mode. And we need to improve the level of teachers' academic standard, rationalize the relationship between scientific research and teaching, providing a powerful guarantee for the promotion of interdisciplinary professional construction.

1. Introduction

At present, human society has entered the fourth industrial revolution era or it is called the period of modern engineering. The construction of new engineering needs to cultivate a large number of new engineering talents on the basis of grasping the connotation of talents needed by modern engineering. In essence, as an academic organization, if the universities want to make great contribution to the society, it must be based on a premise that one should do what he can do and what he is good at. All the functions and activities carried out by the university should be guided by the academic work. This can be applied to the promotion the cultivation of new engineering talents through the construction of new engineering. It means that the inquiry rationality should be treated as the most distinct learning characteristic and the most critical occupation characteristic of the new engineering talents through taking the academic as the basic organization mode.

2. Connotation Interpretation of Inquiry Rationality of New Engineering Talents

The connotation of the inquiry rationality of new engineering talents is mainly manifested in the following four levels.

The first level is the connotation of engineering ontology. The inquiry rationality emphasized by the new engineering talents is reflected in its presupposition that the any essence of the world is not

absolutely static, but always in the process of dynamic development. Even if there is a stable and balanced state, it is only relative, temporary and conditional. Therefore, its ultimate purpose is not the eternal applicable truth, technology, but the process of constantly searching for new discoveries and new applications.

The second level is the connotation of engineering epistemology. It holds that the improvement of any engineering activity and the advancement of any technology can only be realized by means of the critical thinking, an epistemological tool. Any conclusion or result obtained through inquiry can provide new integration space for new theories, methods and technologies to support the development of future projects only if they are constantly questioned and criticized. To explore engineering problems with critical thinking, new engineering talents are required to be equipped with “attention, concentration and curiosity, skepticism, flexibility and inclusiveness to ways various existing claims and evidences, and the ability to investigate and study complex problems, and analyze it based on logical arguments, and propose original solutions, etc.” [1]

The third level is the connotation of engineering methodology. This is mainly embodied in three aspects, including engineering philosophy methodology, general engineering methodology and specific engineering industry methodology. The application of engineering philosophy methodology is due to the tendency that the problems presented by modern engineering are more and more integrated with science, technology and society. The general methodology mainly refers to mathematical research methods applicable for engineering field, mainly including experimental method and inductive logic, mathematical method and deductive logic. The methodology of specific engineering industry mainly refers to the methodology that is unique or idiomatic for a certain engineering industry.

Finally, the fourth level is refers to the connotation of engineering axiology. It has three connotations, containing seeking the true, the good and the beautiful. The true requires that new engineering talents should not distort the true nature of things, and should adhere to the principle of "objectivity" which accords with the inherent law of things as the principle of priority inquiry. The good emphasizes the ethics and applicability of engineering, which regulates that engineering problems should not only be considered in science and technology, but also economic, political, cultural, environment and other Integrated issues. The beautiful requires it to bring people a sense of harmony and pleasure, to establish the idea of "people-oriented", and to pursue the aesthetic factors such as "harmony, order and stability" contained in the regularity and essence of engineering science. [2]

3. Academic Teaching Approach to Promote the Cultivation of the Inquiry Rationality of New Engineering Talents

For a long time, the effect of training engineering talents in Chinese universities is not obvious. It can be seen from the perspective of the relationship between teaching and scientific research. Due to the separated development of teaching and scientific research, scientific research has not been fully and effectively integrated into teaching, and the conversion rate of scientific research achievements to teaching resources is low [3]; Also if we analyze it from the perspective of traditional practice of engineering teaching, we can find that most of them follow the unified training mode, teaching syllabus and teaching management mode, which emphasizes on the knowledge transfer of disciplines and specialties Furthermore, the teaching methods are mainly rely on lecture given by teachers. Engineering practice training is mainly limited to basic skill training, and most of them are confirmatory, demonstrative or simulative. The design method is also more imitative design, with less innovative design and interdisciplinary crossing. Integration and innovation are even less. [4] The above greatly hinders the cultivation of inquiry rationality of

engineering talents. Therefore, we should focus on improving the inquiry rationality of new engineering talents, and vigorously explore and design the training system based on academic teaching.

3.1. Analysis of Operation Principle

The basic operation logic of the inquiry rationality of cultivating new engineering talents through academic teaching is to take the pursuit of inquiry rationality as the object and perform a good links of “what to teach, how to teach and how to learn” based on “academic”. And among these three links, what to teach is the selection of academic resources, how to teach is the problem of transformation of academic resources while how to learn is the internalization of academic resources.

3.1.1. How to Select Academic Resources

The selection of academic resources should conform to the inquiry nature of the content. Firstly, it is necessary to absorb the “science of discovery”, which takes the free exploration of knowledge as the highest pursuit; secondly, it absorbs the “academic of application”, which is the knowledge formed in the interactive process of engineering theory and engineering practice. In the process of absorbing this kind of knowledge, we should pay attention to the promotion of academic level, and avoid the over-generalization and simple of the selected resources, which would underestimate the educational significance of intellectual challenge. Thirdly, we should absorb “comprehensive learning”, and the training of inquiry rationality should not be conducted in a single discipline, but should be refined through multi-disciplinary knowledge. Only through the integrated consideration from multiple aspects can the ability to solve engineering problems be improved.

3.1.2. How to Transform Academic Resources

At present, engineering teaching can be acknowledged as "excellent" in standardization, normalization and technicalization, and can even become a general theory worthy of popularization. However, if it cannot really stimulate students' problem consciousness, arouse students' critical doubt and enlighten students' new thinking even if it is upgraded to a kind of "teaching knowledge", it is also unfavorable to highlight the cultivation of new engineering talents based on inquiry rationality. Therefore, teachers should further clarify the direction and purpose of carrying out the research on "academic research on teaching", which requires teachers to cultivate students' inquiry rationality, so that the teaching methods used can help students to learn how to question and criticize, think independently, express accurately, communicate effectively and teamwork.

3.1.3. How to Internalize Academic Resources

To cultivate the students' inquiry rationality, it should be reflected through the internalization of the students. Therefore, it is also necessary to carry out deep learning at the level of learning. Deep learning emphasizes the “inquiry” performance behind the information conveyed by words, texts and formulas. On the basis of engineering preciseness, it can build up a link between ideas and evidence, laws and latent principles, principles and cases, innovation and creation. It can also use interdisciplinary and systematic thinking to examine the learned contents, conduct new reasoning, form new assumptions, and can develop, design, create, lead and manage the corresponding project or product based on the insist on keep up with professional standards, ethics, actual needs and social influence.

3.2. Operation Mechanism Design

3.2.1. Establish a Professional Orientation Mechanism

Only in the process of satisfying social needs, solving engineering innovation and practical problems can the cultivation of engineering inquiry rationality show its significance and value. Therefore, to stimulate the inquiry rationality of new engineering talents, we should obey the logic of developing new economy in China, and make contributions to adapt to and guide the development of new economy. At present, the construction of new engineering subject in colleges and universities should be oriented to "about 3400 national first-class engineering majors established by the Ministry of Education in the whole country" [5] so as to cultivate talents in the national vital development fields of new economy. In addition, the construction of new engineering specialty cannot be once and for all. It needs to be updated and adjusted timely along with the evolution of key development fields of new economy.

3.2.2. Establish a Knowledge Updating Mechanism

To cultivate new engineering talents, colleges and universities need to focus on the new principles, new materials, new technologies, new structures and new processes required by the engineering industry under the new economy. Promote the integration of subject resources, institutional resources, market resources and social resources inside and outside the university as well as at home and abroad by adapting to local conditions. Actively explore and deeply promote the construction of new organizations such as Future Technical College, Modern Industrial College, Demonstration Microelectronics College, Characteristic Demonstration Software College, First-class Network Security College and Energy Storage Technology College, and construct an integrated and systematic academic knowledge organization chain of "Science-Technology-Engineering-Industry", aiming at stepping up efforts to construct academic knowledge frontier, and timely convert the new industrial technology, new industrial demand and new discipline discovery into specialized knowledge. Students can always practice and apply inquiry rationality by following the discipline and practice front.

3.2.3. Establish Teaching Innovation Mechanism

To cultivate the inquiry rationality of new engineering talents, a new teaching framework needs to be constructed. This kind of framework should be able to carry on the academic-based teaching in the general knowledge course, the specialized course and the experimental practice course. It can also include the undergraduate student of all grades. On this basis, this kind of framework requires the teaching design to fully embody the "scientific research element" engaged in the inquiry with the project-based teaching. Different forms of teaching and learning, such as the inquiry study the laboratory research, the peak experience study, cross-school learning or overseas communication should be carried out extensively.

3.3. Operation Support Construction

To cultivate the students' inquiry rationality, teachers are required to nourish the students with the idea of academic innovation. Therefore, colleges and universities should provide the corresponding system and resource conditions for teachers to be engaged in scientific research and practice, and encourage them to devote themselves to it. At the same time, colleges and universities should balance the relationship between teaching and scientific research. Because of the obvious differences between scientific research and teaching in their own internal attributes, internal logic

and internal tension [6], the advantages of teachers' scientific research will not be automatically transformed into the advantages of educating people. Therefore, colleges and universities should promote the integrated development of scientific research and teaching. An equivalent evaluation system can be built up to promote the mutual transformation of scientific research resources and teaching resources. Finally, this rational construction should be placed in the process of promoting the interdisciplinary construction. For this reason, colleges and universities should "dare away the 'unintentional loss in partial interests caused by the interdisciplinary professional construction, and achieve the goal of strengthening the multi-disciplinary cross-over of science, industry, agriculture, medicine, management, law and so on, so as to promote the integration of literature and engineering, as well as science and technology." [7]

4. Conclusions

Based on the background of China's vigorous construction of new engineering, this paper puts forward that the key to cultivate new engineering talents lies in shaping the students' inquiry rationality, and explains the connotation of inquiry rationality from the theoretical level. In order to stimulate and shape the students' rationality, we come up with the training paths of academic teaching from three levels. Indeed, the advantage of this paper is that it provides a relatively clear theoretical framework, however, whether it can or to what extent it can provide guidance to practice, further test is still needed.

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