

The Application of Quantum Theoretical Thinking in the Cultivation of New Engineering Talents

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Abstract: The cultivation of talents in the new engineering era is mainly based on emerging fields such as quantum technology and artificial intelligence, therefore, the concepts and models of cultivation are fundamentally different from those of traditional engineering disciplines. Furthermore, with the in-depth advancement of new engineering construction, the drawbacks of "Emphasizing skills over humanities" and "Prioritizing instrumental theories over rationality of value" in the cultivation of traditional engineering talents are becoming increasingly prominent. Aims to systematically integrate quantum thinking, especially the boundary characteristics that cause splitting of energy-level, into the new engineering talent cultivation system. It guides students to break through traditional engineering thinking in aspects such as cultivating students' systematic thinking, shaping their altruistic values, and forging their practice of integrating knowledge with action, and to foster a worldview and methodology that are suitable for current engineering education. The practical results show that this model effectively enhances students' insight, imagination and problem-solving abilities when facing complex systems, artificial intelligence, innovative design and other issues, providing new theoretical guidance and new paths for cultivating new engineering talents.

Keywords: New Engineering Disciplines; Quantum Theory; Talent Cultivation

1. Introduction

The new round of scientific and technological revolution and the accelerated evolution of industrial reform, the cross integration of artificial intelligence, quantum theory, new materials and other cutting-edge technologies, put forward new requirements for the thinking mode and ability structure of engineering talents.

As the core of China's higher education reform, the construction of new engineering courses has defined the talent training goal of "thick foundation, strong intersection, innovation and good practice". Quantum theoretical thinking is a thinking revolution for the construction of new engineering. Integrating quantum theoretical thinking into the training process of new engineering talents and realizing the educational transformation from knowledge inculcation to thinking empowerment has important practical significance for cultivating innovative talents with quantum thinking.

Under the wave of the fourth industrial revolution, engineering problems have become increasingly complex, systematic and globalized. Higher engineering education calls for new engineering talents who are "proficient in both Taoism and physics". That is to say, we should cultivate interdisciplinary compound and interdisciplinary talents to meet the needs of emerging fields such as artificial intelligence, big data, intelligent manufacturing, robotics, cloud computing and so on [1]. Future engineers need not only exquisite "tools" (technical skills), but also profound "Tao" (humanistic quality and value judgment), with scientific thinking, to find the law of things' development, so as to meet the comprehensive challenges brought by artificial intelligence, climate change and sustainable development [2]. However, the thinking paradigm of the current traditional engineering education system is deeply influenced by Western reductionism and logical analysis thinking, which to some extent leads to the fragmentation of students' knowledge structure, the limitation of innovative thinking and the lack of humanistic care. Students lack systematic cognition, which makes it difficult to see the long-term and huge chain reaction of the system from the local subtle changes, and are prone to learning field and direction deviation; At the same time, there is a lack of awareness of the collaborative cooperation concept required for

the cultivation of new engineering talents, which can not be integrated from the perspective of the overall environment and platform. Therefore, it is very urgent and important to explore a world outlook and values that are conducive to cultivating students' innovative thinking and realization path. Quantum theoretical thinking can undoubtedly play an important role [3]. the training of new engineering talents is particularly important.

2. Basic Principles of Quantum Theory

Quantum theory is one of the most successful theoretical systems to explain the behavior and laws of microscopic particles born in the 20th century. the underlying logic of this theory actually covers the whole mechanism of how human beings explore and understand the world. the theory skillfully links the basic property of matter, wave particle duality, with Schrodinger equation, and thus explores the characteristics and laws of quantum properties of energy levels of matter by mathematical methods [4]. As shown in formula (1):

$$\left[\frac{-\hbar^2}{2m} \nabla^2 + V(r) \right] \varphi = E \varphi \quad (1)$$

Where $\varphi(r)$ is the wave function of a single electron, e is the eigenvalue of the electron energy, $V(r)$ is the potential energy function of the metal energy, and R is the electron potential vector in the metal. If $V(r)=0$, then there is the energy level expression of formula (2):

$$E = \frac{-\hbar^2 K^2}{2m} = \frac{-\hbar^2}{2m} (K_x^2 + K_y^2 + K_z^2) \quad (2)$$

After introducing the periodic boundary condition L , the energy solution of the Schrodinger equation is quantized, as shown in formula (3):

$$E = \frac{\hbar^2 K^2}{2m} = \frac{\hbar^2}{2m} \left(\frac{2\pi}{L} \right)^2 (n_x^2 + n_y^2 + n_z^2) \quad (3)$$

It can be seen that the larger the L value, the less obvious the quantization we observe, so that more energy levels (or substances) can be observed by us. the increase of L value reflects systematic thinking, and it is not allowed to look ahead and backward due to temporary changes; the increase of L value also requires us to have the idea of "altruism without self" in the process of interaction with things, so as to achieve a more perfect value of life; At the same time, it requires the unity of knowledge and action. Without such quantum thinking, it is actually difficult to logically link cognitive development

with practical implementation.

3. Exploration and Practice of Applying Quantum Thinking to the Cultivation of New Engineering Talents

The introduction of quantum thinking into the new engineering talent training system can be explored and practiced from three dimensions: cultivating students' systematic thinking, shaping students' values, and forging students' practice of unity of knowledge and practice.

3.1 Cultivate Students' Systems Thinking

Quantum thinking has the characteristics of integrity and relevance, which breaks the limitations of the traditional barriers in the cultivation of engineering talents. In the quantum world, microscopic particles do not exist in isolation, but are inextricably related to their environment and other particles. Mapping this feature to talent cultivation requires that it should not be limited to a single field, but should have systematic and holistic thinking. Now the knowledge system faced by the new engineering specialty is extremely complex, so students must have a systematic and overall concept. This is clearly reflected in quantum thinking, that is, the L value in formula (3) should be increased. In the education and teaching of new engineering majors, students should always pay attention to the whole process or global observation of knowledge and all kinds of things they encounter, and break their original discrete, limited and structured cognitive mode. We must make students deeply understand that the problem is never a single existence, but may be due to our own cognition. Taking the newly established college of interdisciplinary sciences at Liaoning University of technology in 2024 as an example, although all teachers and students are aware of the rapid transition of the development of the times from traditional manufacturing to intelligent manufacturing, AI is also profoundly affecting people's production and life. However, according to the survey of 60 freshmen in grade 2024, many students are very confused about the employment situation of new engineering and the future development trend of their major because intelligent manufacturing is relatively fashionable and their professional understanding just follows the declaration of the market. Obviously, such a temporary blind choice of major will not help students' interest in learning and future professional output, or even slack off

or even give up in the learning process. Using quantum thinking, on the one hand, in the first semester of "Introduction to specialties", we require teachers to explain the emergence and development of these new engineering specialties to students in an all-round and systematic way, and at the same time, increase academic reports or training in various fields related to intelligent manufacturing; On the other hand, students should be encouraged to lay a good professional foundation and form an overall view of analyzing and solving problems in the future, without being bound by shortsightedness.

If the L value of quantum thinking is increased and used in discipline evaluation, the cultivation of systematic thinking can also improve the ability of interdisciplinary integration, help students break discipline barriers and promote interdisciplinary integration. Systematic thinking provides students with a framework to integrate multidisciplinary theoretical knowledge, organically integrate these knowledge, break the limitations of a single discipline and cultivate interdisciplinary talents, which is especially suitable for the cultivation of new engineering talents. At the same time, the increase of L value in quantum mechanics can also be related to time. That is to develop dynamic thinking, from the "limited resources view" to the "abundant flow view", and cultivate students to learn to see the world with a "flow" view, and understand that things are always changing and developing. I believe that beauty can expand infinitely, and through selfless giving, it may stimulate a greater energy cycle. They will think dynamically, not just a "snapshot" at a certain point in time [5]. This is very important for understanding the dynamic process such as technology evolution.

3.2 Shape Students' Altruistic Values

New engineering majors usually need to face a wide range of interactive processes of industrial control, sensing and regulation, which requires each device to "work" with each other. According to quantum thinking, our values are not infinitely gradual continuous energy level EK, but are composed of discrete core principles, moral boundaries and priorities, which requires us to define the energy level of our own position when facing the interaction of things. Generally, setting boundaries for yourself will make it more "free". According to formula (3), students can

change their thinking mode, expand or remove the boundary to reveal more EK and obtain better interaction. This requires us to be more vague about the boundary at the conscious level. When dealing with the interaction between people and things, we should shape altruistic value, selfless dedication without return, and evolve to "unity", "self", "altruism".

Only in this way, students can deeply perceive the harmony and accessibility of the interaction of various things in the learning of new engineering, and then improve the deep understanding and good experience of engineering education and the universe. Confucian idea of "benevolence": "stand up for yourself and reach out for others" [6]. If you want to succeed, you should also help others succeed; If you want to be accessible, you should also help others to be accessible. It perfectly interprets the unity of egoism and altruism, which is similar to quantum thinking.

On the other hand, the result of formula (3) shows that when the L value is very small, many energy levels cannot be observed, and the energy levels are seriously separated, so the students' vision is naturally narrow and show self-interest behavior. As a provincial local university, many of its students' value concept is better egoism, and even promote a refined egoism and think more about themselves. According to quantum thinking, with the expansion of L value, more energy levels will be observed and the energy levels will be more continuous. At this time, there are actually more altruistic behaviors in students' consciousness. As an important element of Ideological and political education in the curriculum, teachers should use quantum thinking in the teaching process to help students establish correct values, and guide that only by shaping altruistic thoughts can we expand the boundary and improve the energy level changes of our daily interaction. After I explained this idea in my students' introduction to quantum mechanics, many students seem to understand the true meaning of life, often showing altruism and helping others, and improving their learning enthusiasm and passing rate.

With the above-mentioned quantum thinking, "altruism" has become a logical necessity. In daily life, this mode of thinking will actively stimulate students' empathy and empathy, and encourage students to participate in community services, environmental protection activities, labor activities, etc. through social practice,

lectures, etc; Connect classroom knowledge with practical problems in the real world, so that students can see how what they have learned can be used to improve the society and enhance their sense of social responsibility and civic awareness. For example, when the college learned that some students' families were in difficulty, the teachers made records to pay attention to the families in difficulty in time and organized teachers and students to donate money, which explained the idea of selflessness and altruism, and trained students to be responsible, responsible, caring for friends and loving the collective. Let students learn to think from the perspective of others. Understand and respect individuals from diverse cultures and backgrounds, and have empathy and empathy.

3.3 Forging Students' Practice of Unity of Knowledge and Action

The new engineering specialty especially emphasizes the ability of students to solve problems by using various agents as a whole, and emphasizes various application scenarios and ecological innovation. According to the above quantum theoretical thinking, the development of students is not limited to a continuous and unique path, but actively choose their own growth position among the discrete possible options [7]. the energy level that everyone ultimately chooses or defines constitutes their unique learning, life and even life trajectory.

In the process of cultivating new engineering talents, students' transformation from pursuing personal success, wealth, reputation and other "personal" goals to the ultimate meaning of life "how to make the world better" requires the deep binding of personal happiness and collective well-being. This kind of value concept guided by quantum thinking is precious. Students must transform this cognition into practice and achieve the unity of knowledge and practice. In the talent training of new engineering, we should always cultivate students' ability of combining knowledge with practice [8]. If quantum thinking is the right "knowledge", then its practice is the right "action", which requires the unity of knowledge and action in education and teaching practice. Knowledge is not only theoretical cognition, but also action in practice. At present, the employment situation of new engineering majors is also complex, and students' understanding of economic

development and the situation at home and abroad is not deep enough, which leads to the weariness of some students. At the beginning of the enrollment of new engineering majors, the College of interdisciplinary sciences of Liaoning University of technology made an in-depth analysis of students' professional training and employment situation, trying to form a new mode of interdisciplinary training of new engineering majors. However, many students do not have a deep understanding of the solutions under this new situation. For example, taking the postgraduate entrance examination for advanced mathematics and English are difficult subjects, which requires students to lay a good foundation for learning during the undergraduate period. But during the freshman year, about 8% of the students failed in advanced mathematics and English. It can be seen that students lack a thorough understanding of the concept of the unity of knowledge and action advocated by quantum thinking, which leads to the lack of execution of practical actions, and learning becomes a problem that teachers should repeatedly urge. It can be seen how important it is to understand the underlying logic of quantum thinking. Later, our college also took some measures to solve the problem of failing to pass the course. the head teacher of Mathematics Department urged students to learn advanced mathematics and improve their grades; In the process of learning English, we have chosen teachers with rich experience in English to guide students and lay a good foundation for students' postgraduate entrance examination. But the most important thing is that we will expand the professional course of introduction to quantum mechanics into a public elective course in schools to improve the logical cognition of professional students. Only by having a deep understanding of "knowledge", can we "do" simply, so that we can more effectively transform it into practice.

4. Conclusion

To sum up, in the cultivation of new engineering talents, through the cultivation of students' systematic thinking, shaping students' altruistic value and forging students' practice of unity of knowledge and action, we can make full use of the underlying logic deduction of quantum thinking to enable students to form a world outlook, values and outlook on life suitable for the cultivation of new engineering majors. At the

same time, this mode of thinking is also conducive to the intersection of different disciplines, breaking barriers, and cultivating compound talents to meet the needs of the times. In fact, quantum thinking is no longer a simple education that regards students as passive machines, but an educational philosophy that has unlimited possibilities and is more suitable for the complex world in the future. Exploring the application of quantum thinking in the cultivation of new engineering talents will eventually promote a "quantum leap" in the field of education.

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