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Collaborative Development of Future Learning Centers in Engineering University: From "Understanding History" to the "Infinite Library"

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Abstract: The collaborative development of future learning centers in engineering university is a crucial component of integrating education, technology, and talent development. Its essence lies in cultivating top-notch innovative engineering talents with both scientific and technological literacy and humanistic feelings for the great rejuvenation of the Chinese nation through a historical narrative and a deep understanding of engineering talent cultivation in China. By tracing back to the formation of educator Mei Yiqi's engineering intentions, the integration of engineering knowledge, and the history of engineering education governance, this paper proposes the key to the collaborative development of future learning centers in engineering university in the era of artificial intelligence. Firstly, it is necessary to update educational concepts and view learners as dynamically self-empowered individuals with plural existences. Secondly, attention should be paid to dynamic knowledge of possibilities, and cross-subject and interdisciplinary cognition and reflection should be carried out based on the types of engineering knowledge. Thirdly, it is essential to establish an engineering talent cultivation model with problem-guided knowledge learning as the core. With the support of digital network platforms and artificial intelligence technology, an infinite link of ideas and knowledge can be established through comprehensive textual methods, constructing learners' own "infinite library" and a spiritual world that is proactive, creative, and cultural.

Keywords: Engineering university; Future learning centers; Mei Yiqi; Top-notch innovative engineering talents; Collaborative development

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1. Introduction

The coordinated development of future learning centers in engineering university and universities is a crucial component of integrating education, technology, and talent development. Its essence lies in updating educational philosophy, deepening the transformation of learning knowledge, and reforming talent cultivation models through a historical narrative and a deep understanding of engineering talent cultivation in China.

This aims to cultivate top-notch innovative engineering talents for the great rejuvenation of the Chinese nation. Expanding and deepening research on the coordinated development of future learning centers in engineering university and universities, on the one hand, is conducive to leveraging the power of the "new engineering" discipline to lead higher education reform within the "Four New" construction initiative. This explores and creates an innovative, compound, and applied talent cultivation model with Chinese characteristics. On the other hand, it helps clarify the development direction and mission of future education in China's engineering university and universities, highlights the supporting and leading role of "future learning centers" in the higher education talent cultivation system, and contributes a "Chinese solution" to international engineering talent cultivation models.

2. "Empowering the Future": The important mission of engineering university and universities in serving the country's new development strategy

The 20th CPC National Congress clearly stated that "education, science and technology, and talent are the fundamental and strategic supports for comprehensively building a socialist modern country." To deeply implement the strategy of rejuvenating the country through science and education, the strategy of strengthening the country through talents, and the innovation-driven development strategy, higher education needs to overcome the lag of the "slow variable" of education, accurately grasp the development trend of higher education, not only to identify changes ahead of time, but also to respond scientifically to changes, and even more importantly, to actively seek changes [1]. In the wave of the new technological revolution and industrial transformation, China's higher engineering education provides strategic leadership for building a modern and powerful country in an all-round way, and also provides Chinese experience for the development of a community with a shared future for mankind. Serving the new needs of national strategic development requires the construction of new engineering disciplines, building new advantages in international competition requires the construction of new engineering disciplines, and implementing the new requirements of cultivating talent requires the construction of new engineering disciplines [2].

New engineering is not a partial consideration, but a major strategic choice for engineering education reform in the context of the new technological revolution, new industrial revolution, and new economy. It is a new way of thinking and a new approach for the future development of engineering education in China. Currently, our understanding and construction of the "Future Learning Center" in engineering university and universities is still ongoing. After the three steps of new engineering construction: Fudan Consensus, Tianda Action, and Beijing Guidelines, a consensus on the construction of new engineering has been reached, presenting three perspectives of "enabling the future."

Firstly, from the perspective of future philosophy, it is realized that in the transition from natural human civilization to technological human civilization, the mission of "future philosophy" is to face the technological life world deeply transformed and reshaped by the technology industry. Contributions need to be made to rebuild the experience of the new living world of today and the future. "The future has come," and this turn in human civilization has already and will continue to profoundly affect the development and reform of higher engineering education. The second is to have a clearer and more accurate understanding of the future development trend of higher engineering education. Only with a more open school-running model, a smarter environment, more advanced teaching methods, smarter evaluation, more efficient management, and newer educational mechanisms can we cultivate talents who can adapt to and promote

future development. Third, the "Future Learning Center" will become an important fulcrum to promote the third transformation of the talent training model in higher engineering education. The first transformation was in the era of the machine industry, emphasizing an "engineering technology education model" based on engineering technology. The second transformation was in the era of information science, highlighting the "engineering science education model" that integrates scientific research and engineering technology. The third transformation is in the era of artificial intelligence, focusing on an "engineering-led education model" that integrates science, technology, and humanities [3].

3. "Understanding History": A retrospective on Mei Yiqi's cultivation of top-notch innovative engineering talents

"Strengthen historical confidence and enhance historical initiative." History not only contains rich traditions but also inspires the path to future development. Through the interpretation of understanding history from the perspective of phenomenology, this paper traces back to the formation and practical journey of educator Mei Yiqi's thoughts on cultivating engineering talents, presenting three main characteristics.

3.1. The formation of engineering intentions in the historical context of the same destiny of family and country

Human conscious activity is not, as the representationalist imagines, a projection of the ready-made external world onto a ready-made screen inside the mind. The "inside" of consciousness is not a flat screen; consciousness has "depth." The presentation of every object of consciousness has a certain structure, and layers of premises precipitate to form the stage for the corresponding object to appear. The "intentional history" starting from phenomenology does not aim to provide a universally applicable historical "model" but rather aims to give a clue to narrate history or a clue to understand the historicity of our current situation. Such historical clues are endless, and every concept does not come into being out of thin air; every concept has its own "history [4]."

During Mei Yiqi's student days, "studying classics to pursue a career in government" was the most common "consciousness" among Chinese scholars. Mei Yiqi had been familiar with and could recite classics since childhood. Foreign colleagues called him a "knowledgeable and memorable Chinese Confucian scholar." His colleague recalled, "He once told us that if anyone among us recited any ancient Chinese classics with mistakes or omissions, he could continue reciting any chapter." Why didn't Mei Yiqi continue to follow the path of "studying classics to pursue a career in government" like most people of his generation? The historical situation of the fate of the family and the country being intertwined is an important perspective worthy of attention. From the perspective of the fate of the "family," Mei Yiqi was born on December 29, 1889, in Tianjin's Drum Tower West Banqiao Hutong, with his ancestral home in Wujin, Jiangsu Province. Although the Mei family has always been a family of poetry and books, and poetry and books are the first requirement for their children, the Mei family had declined by the end of the Qing Dynasty. There is a historical detail: during Mei Yiqi's four years of study in the United States, his father was unemployed, and the family in Tianjin lived a very tight life. Mei Yiqi lived frugally and sent money back home to help with daily expenses. From the perspective of the fate of the "country," China in the late Qing Dynasty and early Republic of China was unstable due to warlord fights and revolutions. Although the "Gui Mao school system" promulgated in 1904 established the status of engineering in China's education system, relying on Western industrialized countries was still a helpless reality. The reason why Mei Yiqi was able to pass the

exam among 630 candidates and become one of the first "direct students to study in the United States" in 1908 was partly due to his own efforts since he enrolled in Tianjin Nankai School until he was recommended to study at Baoding Higher School. However, it has to be admitted that the historical background that prompted the Qing government to establish the "You Meixue Office" in 1909 to recruit students to study in the United States was actually passive, as this measure was a response to the US decision in 1908 to return the "excess" portion of the "reparations" from the war of aggression in 1900 to China as funding for sending students to study in the United States.

Despite the helplessness in choosing his studies due to historical circumstances, Mei Yiqi demonstrated a pragmatic and independent spirit when selecting a school in the United States, as well as a strong commitment to engineering disciplines. This reflected his personal aspiration for engineering as a means to contribute to the betterment of his country's future. The influence of traditional Chinese learning from his early upbringing played a latent yet significant role in shaping his later knowledge structure and educational governance.

3.2. Integrating engineering knowledge in the historical intersection of old and new learning

Human historical movements do not have any absolute limitations in terms of their foothold, and thus, the horizon is not closed or narrow but constantly changing with human activities. In this process, the past and present horizons "together form a large, inwardly moving horizon that transcends the boundaries of the present and encompasses the historical depth of our self-consciousness." Therefore, understanding is the process of continuous integration between past and present horizons, which are seen as independently existing [5].

Starting from Mei Yiqi's choice to study electrical engineering at Worcester Polytechnic Institute during his studies in the United States, or even earlier, when he followed Mr. Zhang Boling, who taught science at Nankai School in Tianjin, the type of knowledge he acquired was no longer the static, singular, and repetitive "old learning" knowledge in the traditional sense of Chinese classical education. The emergence of "new learning" knowledge, including engineering knowledge, in modern times is not only a historical necessity for the development of knowledge from epistemology to transcendentalism, but also a new force of knowledge that is crucial for reversing the fate of the nation and its people. The bloody fact that traditional Confucian education knowledge could not withstand the advanced Western warships and cannons repeatedly demonstrates that "old learning" knowledge can no longer explain the dynamics of existence or the passive and uncertain fluctuations of the fate of the family and the country. What is needed is a kind of knowledge that can confront and change the current historical situation and enlighten a new future for the country and nation. The emergence of engineering knowledge in the intertwined historical time and space of new and old learning is not accidental. As mentioned earlier, the reason why the "engineering technology education model" emphasizing engineering technology was formed during the first transformation of higher engineering education talent cultivation models in the machine industrial age was largely due to the urgent need for engineers with specialized technical and engineering knowledge at that time, distinguishing them from craftsmen or workers who only had operational skills but lacked systematic education. Taking the United States as an example, there were only about 30 engineers in 1816. Later, due to the construction of large-scale civil public works such as canals and railways, by 1850, there were about 2,000 engineers in the United States. From 1880 to 1920, it was the golden age of professional development for American

engineers. During these 40 years, the number of engineers increased by more than 18 times, from 7,000 to 136,000 [6].

From 1910 to 1913, when Mei Yiqi studied in the United States, it was the golden age of professional development for American engineers. During this time, he not only acquired the most advanced engineering knowledge in the world but also continued to diligently seek new knowledge and strength after obtaining his bachelor's degree in engineering. In November 1928, he returned to the United States to serve as the supervisor of the Tsinghua University Student Supervision Office in the US. In August 1929, he went to the University of Chicago for further study as a Tsinghua teacher with public funding, and in the summer of 1930, he obtained a master's degree in mechanical engineering. By the end of 1931, he returned to China to serve as the president of Tsinghua University. Mei Yiqi's experience of studying in the United States and later visiting the country three times undoubtedly gave him a comprehensive and thorough understanding and appreciation of the mainstream thinking and current situation of American university education, laying a solid foundation for the formation and development of his generalist education philosophy [7]. During this process, engineering knowledge "emerged" from the historical spacetime, gradually deepened its transformation, and was integrated into Mei Yiqi's personal knowledge construction.

3.3. Managing engineering education in the historical practice of Tsinghua University and Southwest Associated University

To truly understand and change history, we cannot merely emphasize the rationality of foreknowledge, authority, tradition, and enlightenment. A deep understanding of history lies in enabling every subject to be freed from the shackles of historical traditions, without authoritative coercion, so that all participants can successfully achieve self-reflection through dialogue, eliminate various prejudices through reflective criticism, mutually recognize each other while maintaining their own differences, reach consensus with others, and freely unite into a rational communication community [8].

After the September 18th Incident in 1931, the national crisis became increasingly severe, and it was urgent to accelerate the process of national defense construction and industrialization. Mei Yiqi served as the president of Tsinghua University from October 1931 to 1938, and as the executive member and chairman of the Academic Committee of the National South-Western Associated University for a total of 18 years. During this period, he strongly advocated for reforming the engineering education model based on the theory of "generalist education" to cultivate high-quality specialized talents urgently needed for the development of modern industrialized society. As an engineering physics expert who studied in the United States, Mei Yiqi's historical practice and governance effectiveness in cultivating engineering talents are mainly reflected in three aspects.

Firstly, updating educational concepts and establishing the idea of strengthening the country through strong engineering education. Mei Yiqi believed that to change the backwardness of the country, it was particularly necessary to strengthen science and engineering education. When he was the president of Tsinghua University, he established the idea of developing engineering disciplines. During his time at the National South-Western Associated University, Mei Yiqi attached great importance to thinking about engineering education in the context of the country's future. In his article "The Future of Industrialization and Talent Issues," published in 1948, he proposed that industrialization is the most important aspect of national development, involving major issues such as resources, capital, and talent. The talent issue has two parts: one is about technology, and the other is about organization. The most effective way to improve the

system and change the atmosphere is through education. This atmosphere refers to changing the insufficient understanding of engineering. He pointed out in the article that "in the past, in the country's education system, talent selection policies, and accumulation of literature, engineering was considered something inferior. Because it was inferior, the status of engineering has been declining [9]." This was an important "consciousness" orientation for understanding China's destiny and future with innovative thinking and grasping the function of engineering education. Mei Yiqi's engineering education philosophy of "emphasizing breadth rather than specialization, and seeking gradual progress rather than quick results" remains an important educational philosophy that is compatible with Chinese historical culture and national conditions for cultivating top-notch innovative engineering talents today.

The second is to build a modern engineering talent training model with general education as the core. Based on his own insights, Mei Yiqi used the example of a teaching assistant who graduated from an engineering major being overly ambitious and disdainful of hands-on work like installing lights, to propose that engineering education should also emphasize humanities education. "Graduates of engineering schools should have a full understanding of the differences between one engineering field and another, between engineering theory and engineering technology, and between the principles of things and the principles of people. Although they may not be able to handle everything with ease, at least in this complex situation, they should have a minimum ability to cope. Only such individuals can have the power to organize industry and become the leaders of industrial construction that the country urgently needs at present" [9]. "True industrial organization talents should have a full understanding of psychology, sociology, ethics, and even all humanities, cultural backgrounds" [9]. "They should also be exposed to a large part of the humanities and social sciences. The more exposure they have, the more knowledgeable they will be, and the fewer difficulties they will encounter in organizing material and human resources in the future" [9]. To this end, he proposed reforming the engineering education model with the theory of "general education," through "five types of courses" (first-year common required courses, required courses in their own department, required courses in other departments, elective courses in their own department, elective courses in other departments), so that students can acquire general knowledge in natural science, science, and humanities, breaking through the limitations of sticking to their majors. Although the Ministry of Education during the period of Southwest Associated University advocated science and engineering and suppressed liberal arts, Mei Yiqi did not agree with this approach. Instead, he insisted that students, whether in liberal arts, science, or engineering, should handle the relationship between "breadth" and "solidity" of knowledge [7].

The third point is to emphasize the important role of library modernization in collaborative education. In 1994, Singapore published an important document related to the future of libraries, "Library 2000," which had a significant impact in the international library community. The report proposed seven aspects of the "paradigm shift" in libraries, which are admirably still relevant even today [10]:

(1) From being a library custodian to being a service-oriented information provider;

(2) From single media to multimedia;

(3) From local collection to a borderless library;

(4) From us going to the library to the library coming to us;

(5) From providing information on time to providing it instantly;

(6) From in-house processing to outsourcing;

(7) From regional service to international service.

The Southwest Associated University Library adopted advanced cataloging methods for book cataloging

and established and improved book borrowing rules based on actual conditions, building a professional, efficient, and humane modern library management and service system. Different aspects, such as the urgent transportation of books from Tsinghua University Library [11], the distribution of the library buildings of Southwest Associated University [12], the unique reading life and diverse reading types of the people at Southwest Associated University [13], and Yan Wenyu's application of his knowledge to the operation of the library, making it one of the best libraries in wartime China [14], reflect the multi-dimensional fit between the Southwest Associated University Library and the modern library paradigm. It also reflects the importance and support that Mei Yiqi, who served as the president of Tsinghua University and Southwest Associated University during this period, placed on the collaborative educational function of the library.

4. "Infinite Library": A learning center empowering future top-notch innovative engineering talents

The "Future Learning Center," as an important pivot for promoting the third transformation of higher engineering education talent training models, is based on modern information technology, educational philosophy, and practice. It has already or is surpassing the significance of physical "limited libraries" for learners. Through diversified and personalized learning models, informatized and digitized teaching methods, focusing on both knowledge and skills, creating an open and integrated learning environment, as well as a practice-oriented, industry-academia-research integrated education ecology, it forms a scenario-based construction oriented towards Education 4.0 [15]. Although times are changing, even Mr. Mei Yiqi, who had a forward-looking perspective, could not have foreseen the profound changes brought about by the rapid development of artificial intelligence in higher engineering education today. However, the "way" of educating people remains unchanged. Updating educational concepts, deepening learning knowledge types, and reforming talent training models are still three important issues that need to be addressed for the collaborative development of future learning centers in engineering university. When new technologies usher in the "Infinite Library," enhancing understanding of these three aspects becomes the key to collaborative development:

4.1. Renewal of engineering education concept-learners as self-empowered individuals

Amidst the three fundamental tasks of future philosophy: technology and the future of humanity, new life experiences, and protecting individual freedom, the rediscovery of subjectivity's ability to create something stronger than itself has emerged as a significant force. "Self-empowered" learners not only represent a crucial manifestation of educational subjectivity in cultivating engineering talents but also enrich the concept of learner subjectivity beyond the traditional "student-centered" approach. Mei Yiqi's own educational journey reflects a process of continuous self-discovery and renewal through "self-empowerment."

Currently, engineering education influenced by future philosophy grasps learner subjectivity based on epistemological philosophy, recognizing free individuals and the existence of a purely rational "singular" subjectivity. More importantly, it acknowledges learners as "plural" subjects with an irreducible and "true" subjectivity. The concept of "plural" subjects implies that each individual possesses their own world. Fueled by emerging technologies like artificial intelligence, every learner can even become a library, maintaining their initiative and creativity through active learning and self-empowerment. Therefore, the most critical concept that engineering education needs to renew is re-examining learner subjectivity, viewing learners as dynamically and pluralistically existing, self-empowered individuals. Only learners who can empower

themselves can empower the future.

4.2. Deepening of knowledge types: Dynamic knowledge of possibilities

Compared to traditional knowledge construction, which is based on noun taxonomy and formal logic to form a pyramidal layered classification of knowledge, the infinite openness and uncertainty of the future unfold more possibilities for the "emergence" of possible knowledge. As a dynamic, reflective, and pluralistic knowledge of possibilities, it is more important to consider the verb-based rational questions of "what concepts can create the future" and "how different knowledge systems can collaborate to construct the future" than "what knowledge is universally necessary". Since no knowledge can self-prove its truthfulness, and no issue or fact in the world exists independently, knowledge needs mutual verification. Future knowledge requires mutual reflection among different knowledges, allowing different knowledges to become meta-languages for reflection, discovering the meta-properties and meta-theorems of knowledge systems through meta-languages and reflective knowledge systems, and restoring the holism of things and issues through mutual reflection as meta-languages, resulting in simultaneously valid plural knowledge. That is, different knowledge about the same object cannot produce only one truth; it is very likely to produce multiple, different, and equally valid truths. Plural truths are mutually enhancing knowledge rather than competing knowledge [16]. The alignment with humanistic knowledge is not a complete negation; its value is recognized through mutual reflection between different knowledge systems, i.e., using an "other" external perspective instead of a mirrored self-reflection. Just as Mei Yiqi used engineering knowledge to reflect on and update traditional Confucian classics in the past, for China's higher engineering education, which has a long history of civilization, it is now necessary to reflect on the value of humanistic knowledge through modern science and technology, rather than simply opposing or undermining it. Regardless of the type of reflection, it is based on the engineering education philosophy that views learners as self-empowered plural subjects, engaging in cross-subject and interdisciplinary reflection, cognition, and learning of the types of knowledge they acquire.

4.3. Reform of talent cultivation model: Problem-guided knowledge learning

"Life is finite, but knowledge is infinite." As complex individuals, "people" cannot exhaust all knowledge in their limited lifetimes. As creative beings, the key lies in recognizing and solving the problems faced in the real world. As a methodology for constructing dynamic relationships of knowledge, comprehensive text emphasizes that the engineering talent cultivation model is not merely about learning engineering or related knowledge, but rather starts from problems and uses them to guide knowledge learning. This transcends the inevitability of traditional knowledge, links all knowledge together to form an infinite network of comprehensive texts, and expands the infinite world of knowledge with problems as the transportation hub. Everyone can establish infinite links of thoughts and knowledge using the comprehensive text method, supported by digital platforms and AI technology, based on their "fate" with the problems. This allows each individual to construct their own "infinite library" where the linking method and knowledge structure remain dynamic. Everyone can reference or borrow from others' infinite libraries, potentially becoming thinkers with both subjectivity and intersubjectivity, forming a "knowledge world" and constructing a spiritual world belonging to creative individuals [16].

5. Conclusion

In the context of unprecedented changes in the past century, serving national strategic development, building

new international competitive advantages, and fulfilling the requirements of cultivating talent with both moral integrity and professional skills urgently require engineering university to strengthen and build future learning centers with new thinking and approaches. This involves exploring new ways to integrate engineering education with humanistic education, promoting engineering university to develop "future learning centers" into ubiquitous, diversified, and personalized new grassroots learning organizations that support learning style changes and knowledge creation. These centers will provide higher-quality contextual support for the high-quality development of higher engineering education in terms of information services, learning services, teaching services, and cultural services. Facing a technological life world deeply transformed and reshaped by industrial technology, the engineering cultural spirit of "wise creators make things, skilled craftsmen explain them," which has accumulated over the long history of Chinese civilization, will make new contributions to rebuilding and leading today's and future life experiences, as well as building a community with a shared future for mankind.

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