



The Fusion and Conflict Between Engineering Education and General Education in China After 1949

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Conflict and Integration between Engineering Education and General Education in Modern China: The Case of TsinghuaUniversity

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Introduction

Since the Chinese Republic revolution in 1911, the relationship between general education and engineering education in China has experienced a series of changes characterized by fusion, separation, to re-integration in five periods as follows: the Republican period (1911-1949), the early days of the People's Republic (1949-1966), the Cultural Revolution period (1966-1976), the reform and opening-up period (1977-1991), and the current period (from 1992 to the early 21st century). This article examines the changing relationship between engineering education and general education in China during these periods. Before 1949, the top ranking institutions, such as Academia Sinica and TsinghuaUniversity in China, directly transplanted American and European ideas about liberal education. During the Republican period, engineering education and liberal education (the predecessor of general education) were in relative harmony.

In the early days of the People's Republic (1949 to 1966), the new Chinese government launched the "Adjustment of Colleges and Departments" movement. That movement established one national higher education engineering system duplicating the Soviet educational system. This new system radically changed the objectives, curricula, and training standards for engineering education. During this period, the number of engineering students increased significantly, which provided much-needed engineering talents for the development of heavy industry. However, engineering education belittled scientific education and only focused on the specific knowledge of engineering; meanwhile, general education was mostly eliminated from engineering programs. Since 1958, China began to review and correct the problems in the Soviet model for higher engineering education, and tried to explore independently its own mode to fit the actual situation in China. During the Great Leap Forward Movement that started in 1958, "a Great Educational Revolution" was launched in order to set up China's unique higher education system in a very short period. Many corrective adjustments resulted from the problems in this campaign that had to be undertaken in

the early 1960s, after which higher education for engineering experienced a period of relative stability.

Then, during the 10-year long Cultural Revolution (1966-1976), both the general education and engineering education fields were hard-hit and fell into anarchy. Chairman Mao Zedong instructed that all the universities of science and engineering, along with other institutions of higher learning in China, should become pioneers in the radical revolution of higher education by engaging in not only intellectual pursuits, but also in practical learning from the workers, peasants, and soldiers. All the universities and colleges stopped admitting students from 1966 to 1970. In 1970, the universities of science and engineering restarted to recruit new students and they developed rapidly. They admitted students directly from ordinary workers and peasants, and designed some typical talent training modes for “Revolutionary Education” by substituting the political education for the normal education¹. As a result, the higher engineering education became highly politicized, and the politically-oriented courses increased greatly.

The end of the “Culture Revolution” in October 1976 marked the beginning of the fourth period, which lasted until 1991. During this new era of Reform and Opening-Up, the engineering education in China gradually recovered its professional training mode, and also tried to overcome its disadvantages. University leaders realized engineering undergraduates’ lack of general knowledge and training and attempted to establish the American-style engineering education mode so as to meet the new economical demands and social requirements.

However, it was during the fifth period (1992 - present), when the central government began to promote the reform and innovation of higher education. General education was reintroduced into engineering programs. Humanistic Education (“Ren Wen Su Zhi Jiao Yu” in Chinese) as a component of general education was introduced into comprehensive as well as engineering universities in the 1990s. The Ministry of Education in 2010 initiated the “Program to Train and Educate Excellent Engineers” (hereinafter referred to as the 'Excellent Engineers Program'), which symbolized that China's reform of higher education had entered a new stage, to meet the needs of the modern, global world and to be future-oriented.

Tsinghua University is consistently ranked among China’s top universities; it is sometimes called the “MIT of China.” As such, it has a pivotal position in China’s educational history. Based on a historical case study that focused particularly upon Tsinghua, this paper examines how national, political, and economic needs shaped the objectives, curriculum, and teaching methods for engineering education in China.

Tsinghua University has played a very important role in the history of engineering education in the People's Republic of China. Its history of both general education and engineering education reflects not only China's own political and social development, but also global trends. The system of engineering education at Tsinghua University experienced numerous changes, often as a result of political movements or changes in governmental education policy.² Influenced by several complicated factors, the relationship between engineering education and general education has been complex. This paper attempts to elaborate on how the relationship between engineering education and liberal education (or general education) changed in the past decades.

It concludes by discussing some current conflicts between engineering education and general education in China, and investigating the social context for these conflicts. Last, but certainly not least, it recommends a few strategies for better integrating engineering and general education. It advocates for proper balance between engineering and general education and calls for a change of the governing structure for engineering education toward one that will combine top-down designs along with autonomy for individual universities and colleges. The objectives of general education should include not only courses of academic knowledge, but also classes for personality development and self-improvement. In addition, both general and engineering education should be better integrated to achieve a greater balance among national objectives, social expectations, and students' overall development.

Liberal Education at Tsinghua University Prior to 1949

The classical education in ancient China, which took the Confucian Four Books and Five Classics as its center and used the imperial examination system ("KeJuZhi Du" in Chinese), to select the most capable people to govern with the rulers of imperial dynasties, resembled the Western classical education in that the latter originated from the ancient Greeks and Romans.³ Both educational systems had the common goals to cultivate well-educated leaders or citizens with knowledge, virtues, and character to serve the nation well, rather than just specific skills for making a living. In modern times, especially the first half of the 20th century, the Chinese traditional classical education system was eventually replaced by a pragmatic logic, when facing the "existential crisis" brought by western countries. It eventually led to the abolition of the imperial examination system in 1905, and the setting up of the modern university system by learning from Europe and America, so as to establish the new school system (including the modern universities).⁴ Meanwhile, liberal arts education was introduced to China, and the engineering education with the strong mission of

promoting industrialization and prosperity also stood out. At that time, Tsinghua University began to play an important role in engineering education in China.

Tsinghua University was established in 1911 on the site of “Qing Hua Yuan”-- a former royal garden in the Qing dynasty, that is, the last dynasty of Imperial China. With part of the Boxer Rebellion Indemnity Scholarship Program returned by the American and British government, the Qing government established “Tsinghua College”(Qing Hua Xue Tang) as a preparatory school to train students who were later sent to study in the United States. The school was renamed “Tsinghua School” in 1912, and in 1928, “National Tsinghua University.”

In its early years, teaching and research at Tsinghua University reflected the idea of liberal art education. Because the start-up and operation of Tsinghua relied entirely on the Boxer Indemnity, and in the early stages of the school its function was mainly to help the Chinese students to improve their language and cultural skills for entering U.S. universities, the teaching focused on liberal art education, particularly in relation to Western cultures.

By the early 1920s, because of worry about the school’s operating funds in the future and the external criticisms calling Tsinghua as the “comprador school” or exclusionist school, the development direction of Tsinghua University gradually began to change from liberal art education into a university of science and engineering emphasizing both applied and basic research. In 1926, Tsinghua set up the engineering division, which included three engineering majors: Mechanical Engineering, Electrical Engineering and Civil Engineering. Its guiding principle for engineering education was strongly affected by the American engineering education system, which emphasized common engineering training and the credit system at school. Courses in the first two years were mandatory for all majors. Students took English, Chinese, Math, and Chemistry, and participated in practical work in the factory. The last two years were devoted to discipline-based teaching.⁵ As President Mei Yiqi said, contemporary society at that time didn't just need engineers with engineering expertise; society also needed engineers with comprehensive training in humanitarian issues and social responsibility.⁶

Tsinghua University and the “Adjustment of Colleges and Departments” (1949-1966)

The idea of a liberal arts education was suspended after the founding of the People's Republic in 1949.

When the People's Republic of China was founded in 1949, engineering education had developed a foundation in China. Several comprehensive universities or colleges in higher education had established their own engineering schools or divisions.⁷ However, neither the number of engineering colleges nor the scope of engineering training could meet the newly founded state's demand for technical personnel. In 1951 there were 42 engineering colleges in China. In addition, six comprehensive universities had set up engineering division, together with 17 so called "industrial colleges." The engineering education system contained 42 kinds of divisions and related courses. Forty-two thousand students were enrolled in engineering education nationwide, which fell much short of the 150,000 technical talents needed by the national government.⁸ On June 25, 1952, the State Council promulgated the "Nationwide Adjustment Scheme of Engineering Colleges" ("adjustment" hereafter).⁹ The adjustment led to a storm in the Chinese education sector. After this unique movement, the number of national comprehensive universities was reduced greatly. Meanwhile, a great number of professional engineering colleges were established. These emerging engineering colleges dramatically increased the number of students in science, engineering, agriculture and medicine. The boost of science and engineering education effectively met the demands for technical talents during the early stage of nation industrialization. At the same time, because of government neglect, the number of students enrolled in humanities and social sciences dropped sharply.

Responding to the labor force pressure created by industrialization, China was eager to emulate the educational model in the Soviet Union. For example, the Adjustment plan ordered all the engineering divisions in Peking University and Yenching University (a missionary school) to be merged to Tsinghua University, whereas colleges of humanities, sciences, law in Tsinghua University and Yenching University were moved to Peking University. The reshuffling made Peking University to be comprehensive, whereas Yenching University ceased to exist. Although some engineering departments from other universities were incorporated into Tsinghua University, the majors eliminated from Tsinghua University were much more than the ones incorporated into it. When the adjustment was finished at Tsinghua on September 12, 1952, it had eight colleges and 22 majors. The adjustment turned Tsinghua University from a multi-college comprehensive university into a multidisciplinary engineering university, with all its humanities departments removed. In order to strengthen political and ideological leadership in engineering colleges, the adjustment also placed Political Instructors in every college to supervise students' academic and social activities. Political Instructors were especially active during the Intellectuals' Thought Reform movement. Under the leadership of President Jiang

Nanxiang, Tsinghua University began to take up the mission of training “the red engineers.”

From 1952 to 1965, Tsinghua University began to adopt the Soviet Union’s model of professional education. Curricula copied from Soviet Union focused on teaching the practical, detailed technical knowledge. Up till 1949, most teachers in China took English as their most important second language. After Soviet Union was chosen to be the exemplar in higher education, many faculty members had to quickly learn Russian in order to meet new and heavy teaching responsibilities. Teachers at Tsinghua University took crash courses in Russian. They also created the first list of technical terms in science and technology in Russian. These terms were later used by a wide range of universities across the country.

Tsinghua University gradually formed the model for training engineering graduates to be “red and expert.” From 1949 to 1966, Tsinghua University trained more than 200,00 graduates, earning the name “cradle of red engineers in China” .“Red and Expert” as an educational objective was put forward by Mao Zedong. Being red means obeying the leadership of the Communist Party, unconditionally subscribing to the communist ideology, and being loyal to all levels of party members and cadres. Under the party rule, the party’s wills were equivalent to the nation’s benefit; hence “red engineers” were considered as patriots. The cultivation of “experts” focused on training specialized senior personnel. The excessive emphasis on specialization separated science education from engineering education; humanities education was seen even less relevant and largely eliminated from engineering curriculum, except for a few courses in political education. This idea was imported from French Academy of Sciences (French/Russian) and the specialized technical school system. In this system, majors and other institutions in schools were carefully designed to respond to social needs. Both of the particular domestic and international situation , and the implementation of the first Five-year Plan (1953-1957), promoted a significant expansion of engineering colleges in a short time.

In his first report to the Central Committee of the Chinese Communist Party, Jiang Nanxiang as the president of Tsinghua University wrote, one of the most fundamental issues that must be addressed by Tsinghua University in the next five years is to gain practical experience in training a large number of new engineers equipped with high technology and political quality. The slogan “the beautiful Tsinghua campus, the red engineer” attracted the hearts of thousands of young students. In 1958, President Jiang Nanxiang addressed the graduates, “If you want to gain a foothold in this society, there are two main lessons for you. The first one is to be obedient (to the party), the

second one is to work excellently. ” This teaching characterized Tsinghua graduates for decades.

When the model of educating “red and expert” engineer was first implemented at Tsinghua University, objections were expressed. In 1957, Chien Wei-zang, professor and vice president of Tsinghua University, had a heated debate with Jiang Nanxiang. Chien Wei-zang opposed the separation of engineering and science. The conflict between Jiang and Chien reflected the different views held by political elites, leading cadres in Chinese Communist Party like Jiang, and the “cultural elites,” professors like Chien. Soon after the debate Chien Wei-zang was labeled a “rightist” and lost his professorships and the right to do research. Although not involved directly in the debate, Qian Xuesen⁵ the director of Institute of Mechanics in Chinese Academy of Sciences privately sided with Chien Wei-zang. As former colleague at Caltech under the guidance of Theodore Von Karmen, Qian shared Chien’s view that engineering education ought not to be separated from science education. Qian established one post-graduate course called “engineering mechanics” by cooperating with Tsinghua University, which was taught at Tsinghua campus and lasted for three years. Qian insisted that engineering learning must combine science education. Before long, the disputes on educational philosophy spread out from Tsinghua University to all the engineering colleges in China. Although Chien Wei-zang and Qian Xuesen were aware of the drawbacks of separating science and engineering, they did not observe that eliminating humanities education from engineers could also produce negative influences. In contrast, emphasis on ideological and political education for engineering students became a definitive feature of Tsinghua University. In 1953, President Jiang Nanxiang proposed the “Double Shoulder Task” for senior students and young teachers who were designated as political instructors. Following the spirit of “red and expert,” “Double Shoulder Task” policy sought to enable technically prominent persons to do political and ideological work, and to equip people with both political advances and professional knowledge.

This political orientation echoed the promotion system in Chinese Communist Party at large. Since 1949, particularly after the anti-rightist movement that started in 1957, “political elites” represented by party leaders had a strong distrust towards “cultural elites,” academics as well as intellectuals who were trained before 1949. Political elites were hence committed to cultivating their own “cultural elites. “Red engineers” became the party’s important symbols. Students who were deemed “red” had a much better chance to be promoted in the political system. In this way, Communist Party in China strengthened its ideology control in universities and colleges. To ensure the political loyalty of “red engineers,” admission policy was tilted to recruit more

children from workers and peasants families into universities and colleges. Several decades later, this policy was considered to be an effective antidote against “elitism” by the historians, which played some role to promote the educational equality unexpectedly.

Being “red” was the overwhelming criterion in the evaluation system under the “red and expert principle. Such criteria not only created the awareness of political dependency in the “red engineers”, but also established the absolute authority of the Communist Party in social life. Many of the “red” Tsinghua graduates who had been political instructors became the backbone of numerous industries; a lot of them also came to top in political power.

In 1958, an anti-conservative, anti-waste “dual movement” was started to advocate for the “mass line” and “three-pronged”. It required technicians, workers and ordinary people should work together in industrial production. “Reform of Thought” was carried out in Tsinghua University, which pushed intellectuals to make their own “Great Leap Forward” by thinking of big transformations. Teachers and students put up posters with such promises. On April 1, Liu Xianzhou led a group of 14 professors and teachers in making a pledge to “a transformation into both red and expert.”¹⁰ Overall, starting in the 1950s, Tsinghua University had been pursuing a Soviet-style “technology supremacy.” In that training program of higher education, humanities and natural sciences were demarcated strictly. In engineering education, except for the ideological and political education, students were cut off from any education in the humanities. In fact, scientific disciplines could not exist independently when separated from the whole science system. The long-time separation between humanities, science, and engineering education created defective ways of thinking and knowledge gaps among engineering graduates.

The Post-Cultural Revolution Era: Reviving Humanities and General Education for Engineers

After the end of the ten-year “Cultural Revolution,” the social atmosphere became relatively loose. People began to yearn for comprehensive democratic rights, freedom, as well as the meaning of life. Besides, people also began to reflect on the problems in engineering education. They noticed the absence of personality formation and the spiritual culture in the engineering education. It was admitted that, in the former model of engineering education, human values were reduced to tools, while the value of technology, which should be used as the tool, was strangely elevated to become the only goal of education. Especially, the political factors, which were naturally an exogenous indicator, were forcibly embedded into the evaluation system of

engineering education and became the absolutely dominant factor. Furthermore, since China began to implement the reform and opening-up policy in 1978, its economic and social development both called for more talents with comprehensive knowledge, and the recovery of cultural awareness made the role of humanistic education increasingly prominent. The public increasingly felt that the humanistic tradition should be the basis of university education. Universities should not only teach domain expertise but also help students explore their own values. As international cultural exchanges with Europe and America increased Western universities' liberal education pattern began to be introduced into China. He Dongchang, a Vice President of Tsinghua University, said that "The mistakes we made since the war of liberation was mainly caused by mistakes in the direction of social science." Many universities began to revive humanistic education. Colleges and departments of humanities and social sciences were restored. Top-class professors in these fields were pursued, and student enrollment in humanities and social sciences increased.

In 1982, Professor Jiang Tianshu at Fudan University sent a letter to Chen Yun, Vice-Chairman of Communist Party Central Committee. Professor Jiang suggested that, according to the abnormal phenomenon that the humanities, science and engineering were separated from each other, which is difficult to adjust to the new trends of interdisciplinarity, he suggested to rebuild Tsinghua University, and made it to be a comprehensive university with a good foundation of liberal arts and science, and the solid engineering. This letter later became the trigger for the rebuilding of humanities and social sciences in Chinese universities. Chen Yun forwarded this letter to Tsinghua University, and the Party Committee of Tsinghua submitted a report to the Ministry of Education in March 1983, saying that "To add the humanities and gradually turning Qinghua into one engineering-based comprehensive university is beneficial."¹¹ Since then, disciplines in the humanities were gradually re-integrated into Tsinghua. Tsing-Hua National Literature Research Institute was established in 2009. Tsinghua started to offer courses in humanities, social sciences, and the arts for undergraduate students. Transiting itself to a comprehensive university, Tsinghua attempted to combine science, humanity, and art education, in order to train the talents with a high aesthetic ability and innovation capacity.

At the same time, other universities also started to rebuild humanities disciplines. In the implementation of a general education reform, Peking University, Fudan University and others universities with more profound humanistic tradition have taken their first step, in order to prompt the fusion of engineering education and humanistic education. In April 1981, Peking University required its students to take elective courses. It required students in the humanities and social sciences to take electives in

science and engineering, and vice versa. Since 1995, the national education policy that aimed at promoting students' cultural quality (文化素质教育) was enacted. In 1997, Huazhong University of Science and Technology established a Students' Cultural Quality Education Base, which was approved in 1999 by the Ministry of Education and became a national cultural quality of university education base. In 1999, the Ministry of Education approved the establishment of 32 students' Cultural Quality Education Bases in 53 universities. These cultural quality education bases usually served as the regulatory agency for general education courses. The Zhu Kezhen College in Zhejiang University, established in 2000, has become the Honors College to offer outstanding undergraduates "special training" and "elite culture". Beijing Normal University launched Liyun classes in general education with three modes, including humanities-based and social sciences-based classics reading, the integrated curriculum focusing on special topics, as well as the core curriculum, so as to enhance students' overall understanding about society. Reforms like this also influenced universities that focused on science and engineering education. For instance, Beijing Institute of Technology, Shanghai Jiaotong University and other technical universities began to introduce general education for their engineering students. In 2003, Beijing Institute of Technology promulgated "Regulations on the Elective General Education Course for Undergraduate," which required undergraduate students majored in information, science and engineering to complete at least six general education course credits before graduation. In 2007, Shanghai Jiaotong University implemented "Administrative Measures of General Education Elective Course (Provisional)", which required students in each major take one to two courses in general education. Beijing University of Aeronautics and Astronautics established a General Education Center. Tsinghua University also set up a Cultural Quality Education Base. The intensity of general education reform will increase.

After the reform and opening up policy, China still did not loosen its ideological and political education. Tsinghua University was praised by leaders of the central government as a model of political education. On June 23, 1978, Deng Xiaoping listened to a report of Tsinghua University and affirmed the various strategies of ideological and political education applied in Tsinghua, including the selection of senior students and young teachers to serve as part-time political workers, and the various experiences in training professionals to be "red and expert." On February 29, 1980, "The Guiding Principles for Political Life in the Party" was approved by the Communist Party of China, which asked party members to be "red and expert." On March 12, 1980, Deng Xiaoping made a speech "Streamlining the Military to Improve

Combat Effectiveness” at the enlarged meeting of the Standing Committee of the CPC Central Military Commission, in which he stressed that the party organizations and faculty in schools must learn the ideological and political experience from Tsinghua, and everyone should be “red and expert.” In particular, Deng reminded everyone that “being red” should not be forgotten. However, this kind of defense just revealed the serious problems in Tsinghua University and other schools in China. The so-called general education course such as “morality” is out of sync with students’ spiritual growth. On January 29 and February 23, 2002, Liu Haiyang, one student of Qinghua abused the bears in Beijing Zoo, which shocked the society. The event reflected the lack of proper moral education and psychological construction in universities.

Conclusion: Lessons and the Way Forward

From the above we see that engineering education and general education had been relatively isolated in China for a large part of the past century. In a series of movements that established the dominance of political ideology in academia through strong administrative intervention, all the humanities disciplines were stripped from engineering schools. The “Adjustment” turned Tsinghua from a comprehensive university with outstanding humanities into a purely engineering college almost overnight. For a long time, loyalty to the party and a focus on practical skills and technological knowledge served the two dominant criteria for evaluating engineering training. Too much emphasis was put on the instrumental value of technology and “political correctness;” humanistic values were ignored. Furthermore, engineering knowledge was divided into excessively fragmented fields of specialty. Graduate students in top-class universities were asked to deal with only specific and practical application, so that human creativity was suppressed. These activities not only deviated from the essence of a liberal education but also curtailed the success of engineering education. Later, under the reform and opening up policy, education in the humanities and social sciences were gradually recovered, yet several new problems emerged.

To begin with, social structures and ethics have been transformed radically in contemporary China. The instrumental view of education was not checked but amplified, as the whole society focused on the central task of economic construction. Engineering education--in addition to its consistent politicization--is also greatly reshaped by commercialization, much like its counterpart in the U.S.¹²The identity of many universities was recast as quasi-corporations, whose obligation was to produce profit for the stakeholders rather than to create and advance knowledge for the public.

Technocratic classes who have real power inside the universities has been controlling all the allocation of resources in education and research, and making money becomes the university's first priority. At the same time, the market-oriented reforms have resulted in the re-emergence of economic capital and economic elite, whose influences drove the content of engineering education to become more practical and technical. Basic research in engineering education tends to be neglected and under funded. Criteria for evaluating engineering schools also changed; graduates' employment rate becomes decisive in evaluating professional education.¹³

Meanwhile, although some humanities disciplines have been recovered, the one-dimensional humanistic education, which is generally accepted by Chinese academics, is not able to provide engineering students with a well-rounded general education. The current humanistic education in China differs from the Western style general education in its objectives, contents, and ways of teaching. To begin with, the connotation of general education is still under debate; hence educators are not entirely clear about the purposes of humanistic education for engineering students. The contents of humanities courses very often echo mainstream political ideology or introduce ideas and information from outdated humanities research, which fail to engage engineering students. The teaching of humanities courses is mostly conducted in lectures, where knowledge is communicated one way and students are not invited to actively reflect on what is taught and apply it to the context of engineering.

Besides, the tension between engineering education and general education has not been properly resolved. On paper, the personnel training standard of Tsinghua University has changed from "red and expert" to "red, expert, and overall development," but the implementation of the new standard in engineering education yields little change. The educational model characterized by "two shoulders task", "political instructor," and "red engineer" still lie at the center for Tsinghua University and engineering education throughout China. Science and humanities education are still relatively isolated from engineering education. In most cases, lip service is paid by a few humanities and social sciences electives, instead of systematic plans for cultivating students' personalities or creating diverse spiritual culture on campus.

According to the University of California Chancellor Atkinson, universities should help shape students' personality and cultivate critical thinking. Such spirit is largely absent among universities in China today. As a result, universities have succeeded at making political, technical, and economic elites, but paled in educating cultural leaders. Since 2010, with reference to the international standards, the Ministry of Education launched the Program to Train and Educate Excellent Engineers, with an

attempt to broaden engineering education. For instance, it has designated greater importance to innovation, consciousness of social responsibility, communication ability, and leadership, all of which indicate more weight for general education.

We see this broad definition of the objectives of engineering education as a positive sign for moving toward a more holistic pattern of engineering education,¹⁴a change entailed by the natural, social, and technical challenges of the 21st century.¹⁵ We suggest concerted efforts to integrate general education and engineering education be made not entirely at the top-level regulatory agencies for higher education. While we recognize the need for regulation and coordination of engineering education at the national level (e.g., the efforts to make accreditation standards that are compatible with international counterparts), we see unique opportunities for individual institutions to develop their own curriculum and pedagogical models based on their teaching resources and institutional missions. A certain degree of autonomy should be granted to educational institutions as long as they aim at students' psychological and moral development.

We also recommend changes to the way humanistic education—the core of general education—is carried out in many Chinese universities at present. The mode of “introduction, principle plus history”, which dominates humanistic education in many universities, has proven ineffective to engage students in engineering. More diverse pedagogical approaches are worth experimenting with. For example, students might be interested by reading, discussing, and questioning classics in humanities and social sciences. Despite the encouragement of “critical thinking,” actual critique has been rare in engineering classrooms, in China and abroad. Students might find it refreshing to actually practice “critiquing.”

The ultimate purpose for discussion of this kind is to help engineering students explore values of their own, facilitating their intellectual and ethical development, and preparing them for a meaningful professional and personal life. We welcome further research and conversation in this direction.

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