Humanities Studios: Vol. 12, No. 4, 2024
Pedagogy, Psychology, Philosophy
Journal homepage: https://humstudios.com.ua/en
UDC 377.3-057.21(510)
DOI: 10.31548/hspedagog/4.2024.34

Training of future engineering specialists in vocational education institutions in China

Gao Zheng*
Graduate Student
National University of Life and Environmental Sciences of Ukraine
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine
https://orcid.org/0009-0007-7991-6394

Abstract. High-quality engineering education is a key driver of technological leadership and economic development in leading countries worldwide, including China. The study analysed contemporary approaches to the innovative development of engineering education, addressing adaptation to the challenges of the new economy. The dual education initiative, which integrates theoretical learning with practical experience, was emphasised. This approach aims to train highly qualified engineers capable of meeting the demands of innovative development and implementing groundbreaking solutions. The study aimed to identify the pedagogical conditions and specific features of training future engineers in China's vocational education institutions. Methods of analysis, synthesis, and generalisation were employed to systematise the findings. The study highlighted key issues in professional training, including passive learning processes, limited opportunities for intercultural communication, and insufficient integration of project-based learning. The role of collaboration with enterprises in development of practical skills among students was emphasised. The study identified essential pedagogical conditions that contribute to effective training of engineering personnel: the use of modular learning, the implementation of information and communication technologies, a focus on independent learning, and the expansion of practical training opportunities. The prospects for an interdisciplinary approach in curricula were discussed, emphasising its role in fostering creative and critical thinking. The study demonstrated that engaging international partners in the educational process can significantly enhance education quality. The practical significance of the study is determined by underlining of ways to improve the training of engineers in vocational colleges. The findings can be utilised to develop educational programs that integrate theory with practice, enhancing the competitiveness of graduates in the international labour market

Keywords: engineers; dual education; vocational colleges; technical education; project-based learning

Received 29.06.2024 Revised 23.10.2024 Accepted 27.11.2024

Suggested Citation:
Zheng, G. (2024). Training of future engineering specialists in vocational education institutions in China. *Humanities Studios: Pedagogy, Psychology, Philosophy*, 12(4), 34-45. doi: 10.31548/hspedagog/4.2024.34.

*Corresponding author

Introduction

Engineering potential forms the foundation of economic success and technological leadership in the modern world. China demonstrates a strategic approach to developing vocational education, particularly in engineering training, which underpins its leading role in the global economy. However, the country's educational system faces significant challenges, including a passive approach to learning, insufficient implementation of active methodologies such as project-based learning, and limited opportunities for intercultural communication. These issues hinder the development of critical and innovative thinking, which are essential for modern engineers (Liu *et al.*, 2023). In the context of the identified problems, it is necessary to supplement them with such problems as the lack of legislative regulation of the rights and obligations of enterprises and colleges in the process of training future engineers and the low level of the image of vocational and technical education.

T. Hao & M. Pilz (2021) noted the positive impact of international educational exchanges and collaboration with enterprises in enhancing students' practical skills and intercultural competence. The authors explored the international cooperation of Chinese technical colleges with colleges and enterprises in other countries. Their proposed international exchange plan includes both the "import" and "export" of resources. The authors emphasise that vocational colleges should integrate advanced educational resources, high-level engineering knowledge borrowed from foreign vocational colleges, actively organise student participation in international exchanges and overseas internships, and support Sino-foreign cooperative projects related to engineering education.

A study by F. Wang (2020) underscores the need to reform curricula by incorporating problem-oriented and experimental methods. The author suggests that vocational colleges should review their educational methodologies, update course content, and focus on implementing problem-based, project-based, case-based, and research-oriented teaching methods. In addition to fundamental technical knowledge and skills, interdisciplinary knowledge should be emphasised. Moreover, interaction between instructors and students should be further promoted and evaluation methods should be reformed to ensure a student-centred engineering education model. The author considers the above recommendations for expanding cooperation between enterprises and colleges, introducing innovative methods and learning tools to be the main issues on which both participants in the educational process and the government, business circles, and scientists should focus their attention.

According to M. Barak *et al.* (2024), integration of natural sciences and mathematics into the methodology of practical tasks should be a core principle of engineering education. Therefore, engineering students should acquire knowledge both passively and actively to solve real-world practical problems in the future. Additionally, R. Neves *et al.* (2021) emphasised that engineering education and active learning are intrinsically linked. Furthermore, the U.S. National Science Foundation highlighted that engineering education should encourage close interaction with industry and incorporate project-based learning (PBL) pedagogies (Liu *et al.*, 2023). Actively acquisition of knowledge will contribute to professional development, but the use of natural sciences in methodology as a main principle is an exaggeration. In terms of collaboration between vocational colleges and enterprises, H. Guo & M. Pilz (2020) advocated for providing on-site practical opportunities for students, suggesting "approximately a year of training in a corporate environment". During the implementation of training programs, enterprises assign engineers as instructors to oversee student participation in research projects. Companies collaborating with vocational colleges are expected to engage in the talent training process and establish joint mechanisms that encompass curriculum design, shared objectives, course

content, implementation procedures, and quality assessment systems (Fedoreiko *et al.*, 2022).

A review of relevant studies revealed that the development of professional skills among future specialists in engineering fields at vocational colleges in China remains insufficiently explored. Existing research often focuses on the cultural and national characteristics of China's vocational education system, narrowing other educational contexts, including the technical aspects of Chinese vocational education. Analysis of current teaching methodologies in vocational colleges and the lack of practical frameworks has made it difficult for researchers to identify best practices for training future engineers under the dual education system. The study aimed to identify pedagogical conditions that enhance the quality of training future engineers in China's vocational education institutions. The main objectives were to analyse key issues in contemporary engineering education, examine existing approaches to addressing these challenges, and develop recommendations for improving educational programs. The scientific novelty of this work lies in identifying practical mechanisms for implementing dual education, which ensures an effective combination of theory and practice. The study's findings were aimed at improving curricula through the integration of innovative pedagogical methods, including modular and interdisciplinary learning, as well as fostering collaboration between colleges and enterprises.

Materials and Methods

To achieve the objectives of this study, several sequential stages were carried out to examine the challenges and specific features of training engineering personnel in Chinese vocational education institutions. The applied methods allowed for obtaining new scientific results aimed at improving the educational process. The first stage involved a theoretical analysis of scientific literature and regulatory documents related to engineering education in China. In the process of research, scientific publications on the development of engineering education in China, the introduction of dual education and the formation of pedagogical conditions for the development of engineering talents, were investigated, namely: Journal of Vocational Education & Training, Prospects and Challenges, Journal of Philosophy of Education, Journal of Education & Work, Research in Comparative & International Education, Advances in Social Science, Education and Humanities Research. An analysis of regulatory documents regulating the development of vocational technical education in China was conducted. Methods of analysis and synthesis were used to systematise information on existing pedagogical approaches, key challenges, and prospects for the development of dual education. Particular attention was devoted to innovative teaching methods, such as project-based learning, modular approaches, and the integration of interdisciplinary courses. Also were used the interpretative-analytical method for conceptual analysis of scientific literature; content analysis of regulatory documentation to determine the main directions of engineering education in China; methods of theoretical generalisation to formulate generalised conclusions and substantiate practical recommendations.

The second stage included a comparative analysis of educational practices, particularly internships for students in cooperation with enterprises and the implementation of research projects. This involved examining models of collaboration between vocational colleges and enterprises, including the creation of corporate clubs and innovation research centres. This stage made it possible to identify effective practices that contribute to developing students' professional competencies. The third stage evaluated the implementation of active learning methodologies. The use of problem-oriented and modular approaches in curricula was analysed. Methods of modelling and forecasting were employed to develop recommendations for adapting these methodologies to the contemporary requirements of engineering education: improving legislative

regulation of interaction between enterprises and colleges, completing the institutional reform of vocational education, expanding international cooperation, and others.

Results and Discussion

Directions for the development of engineering talent in China

Engineering talent fuels a wide range of sectors, from traditional manufacturing to cutting-edge technologies. Its development has led to the rapid expansion of China's high-tech industries and its subsequent dominance in manufacturing and infrastructure. According to X. Liu *et al*. (2023), key strategic sectors reliant on engineering talent in China are:

1. Manufacturing: China stands as the world's largest manufacturing hub, accounting for over 28.7% of global output in 2023. This achievement would have been impossible without the significant number of engineers specialising in mechanical, electrical, and industrial design.

2. Infrastructure development: Chinese engineers are responsible for some of the world's most ambitious infrastructure projects, including the Belt and Road Initiative (BRI, 2023), which spans multiple continents and involves complex construction, mechanical, and civil engineering efforts.

3. Telecommunications and electronics: China's leadership in 5G technology (through companies such as Huawei and ZTE) and its production of more than 50% of the world's electronics underscore its dominance in electrical and electronic engineering.

4. Artificial Intelligence (AI) and IT: China is heavily investing in artificial intelligence, fostering both research and practical applications. This effort is bolstered by a large number of expert engineers specialising in areas such as data science, machine learning, and robotics.

5. Renewable energy and sustainability: China's engineers are at the forefront of renewable energy technologies, particularly in solar, wind, and energy storage. Their expertise is essential to the country's plan to reach carbon neutrality by 2060, rendering the engineers as key players in achieving that goal.

The distribution of engineers across various sectors is essential for understanding the breadth of China's capabilities (Fig. 1).

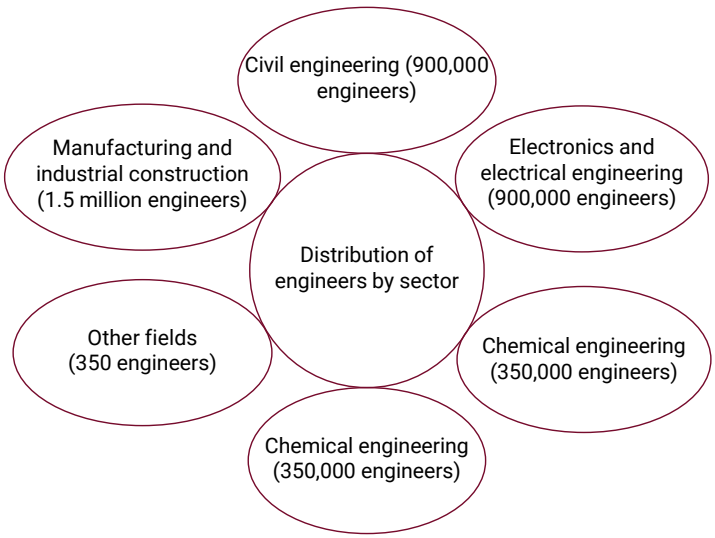

Figure 1. *Distribution of engineers by sector in China, 2023*

Source: *compiled by the author based on data provided by X. Liu et al. (2023)*

A crucial pillar of China's engineering prowess lies in its higher education system, which annually produces a vast number of engineering graduates. However, an equally important yet often overlooked aspect is professional training. Over the past decade, China has produced approximately 1.4-1.5 million engineering graduates annually, accounting for nearly one-third of the global total. This reflects China's strategic focus on STEM education to ensure a steady supply of talent (Liu *et al.*, 2023). Engineers operate in areas of high responsibility, making it imperative to shift the emphasis in the polytechnic education system from merely obtaining qualifications to fostering professionalism. This is critical to ensuring the quality and reliability of technical tasks. Based on the professional engineer program as a comprehensive tool for detailing the requirements for the professional and personal qualities of specialists, a nomenclature of interdisciplinary knowledge, skills, and abilities is determined. This serves as the foundation for successfully performing tasks within a functional-labour complex, incorporating managerial, organisational, and technical components.

Pedagogical conditions for training future engineers in vocational schools in China

One of the essential pedagogical conditions for developing communicative competence in future engineers is the application of a learner-centred approach in education. This approach focuses on fostering dialogic interaction in learning and a dualistic approach to the form of the educational process. According to S. Wei *et al.* (2022), the preparation of future specialists in engineering professions requires specific pedagogical conditions. Table 1 presents several key aspects:

Table 1. *Pedagogical conditions for training future specialists in engineering specialties*

Pedagogical conditions	Meaning
Modular learning structure	dividing the educational process into modules helps students better assimilate material and apply their knowledge in practice
Information and communication environment	creating an environment rich in modern information and communication technologies within professional colleges enhances effective learning
Independent learning	emphasising the development of skills for independent learning and self-education, which is particularly relevant in the context of distance learning
Practical orientation	integrating practical classes and projects into the educational process allows students to apply theoretical knowledge in real-world scenarios

Source: *compiled by the author*

These conditions train future engineers to meet the contemporary demands of professional activity. The primary challenge facing modern technical education in China, and other systems modelled after the Prussian style, lies in passive learning – a classroom-oriented approach centred on the teacher (Wei *et al.*, 2022). This method involves students passively receiving information from educators to memorise for exams or tests. Such pedagogy causes numerous undesirable consequences, including inadequate practical experience, reduced motivation to learn, lack of critical thinking skills, and most significantly, suppression of innovative thinking. A review of scientific literature reveals various perspectives on addressing these challenges. For instance, T. Zhuang & X. Xu (2018) argued that introduction of the foundational principles of "engineering education" can overcome the problem of passive learning in China's vocational technical colleges. Regarding practice-oriented opportunities, S. Wei *et al.* (2022) proposed establishing educational centres within enterprises to serve as bases for engineering practice. These centres may function as workshops or incubation hubs to promote innovation and entrepreneurship. The authors stressed that at least 50% of future engineers should participate in at least one practical

training program during their studies. Recent studies emphasise the importance of active learning methods and an interdisciplinary approach in engineering education. For instance, T. Zhuang & X. Xu (2018) also highlight the integration of natural sciences and mathematics into practical task methodologies, which fosters professional competencies.

Vocational training in engineering is a critical aspect of China's technical workforce. While university education produces engineers with theoretical knowledge and research capabilities, vocational training programs develop technically skilled engineers ready to address practical problems immediately. This system was substantial in Chinese industrial boom and bridging the gap between theoretical education and industry needs. In China, vocational-technical schools have undergone significant development. The country boasts over 10,000 vocational-technical schools, prioritising engineering subjects. These schools graduate hundreds of thousands of students annually, particularly in fields such as mechanical engineering, electronics, automation, and IT. In 2022, approximately 3.6 million students graduated from vocational institutions specialising in technical disciplines, including engineering and related fields (Munkholm & Zhang Consulting, 2024). Graduates of vocational institutions are typically prepared for immediate roles in the industry, whereas university graduates often focus on higher-level, research-based positions. However, both forms of education are increasingly interconnected through collaborative programs between universities and vocational schools.

Chinese manufacturing sector heavily relies on professionally trained engineers and technicians for operating and maintaining high-tech equipment, precision manufacturing, and automation. Vocational training programs in automation, robotics, and industrial engineering were central in industries such as automotive manufacturing, electronics, and consumer goods production. Many graduates join companies, such as Foxconn, BYD, and Huawei, to work on assembly lines, maintain machinery, and program robotics. Chinese transition to renewable energy also depends on professionally trained engineers specialising in the installation and maintenance of solar panels, wind turbines, and energy storage systems. The Chinese government aggressively promotes dual education to increase the number of engineers and technicians. Programs such as the Double First-Class Initiative and the Thousand Talents Plan are designed to develop world-class universities and attract top talent, while reforms in vocational education ensure that practical skills meet industry demands. The government incentivises students to pursue vocational education through scholarships, state grants, and preferential hiring programs (MOE, 2023a; 2023b).

In recent years, China has significantly prioritised improving the quality and accessibility of vocational training programs. The Vocational Education Strategy for 2020-2035 is a long-term policy aimed at building a world-class vocational education system by 2035. A central focus of this strategy is integrating vocational schools with high-tech industries to provide students with training in cutting-edge fields such as robotics, automation, artificial intelligence, and green technologies (The State Council, 2025). China also runs specialised training and retraining programs for technical workers in specific industries, such as coal mining. These programs are designed to requalify workers for roles in emerging fields, including renewable energy and artificial intelligence (CSE, n.d.).

Vocational and technical colleges in China actively incorporate advanced scientific achievements into their educational processes. To ensure the quality of vocational engineering education, these institutions develop full-time educational programs designed to prepare students for immediate employment in production environments. Modern technical colleges combine classroom-based learning with hands-on industrial training to bridge the gap between theory and practice. These institutions aim to provide a flexible and reliable educational process that

combines a strong theoretical foundation with practical tasks. The programs are structured to enable students to acquire professional skills within the shortest possible time frame (Wheelahan & Moodie, 2017). Curricula also include interdisciplinary courses in subjects such as economics, foreign languages, humanities, arts, and music. These subjects are central in enhancing the professional competencies of future engineers. Foreign language education is also emphasised as it helps students develop vital communication skills for engaging in international business and professional exchanges. The breadth of professional courses reflects the focus of Chinese vocational colleges on implementing modern technologies and methods in engineering education. Most vocational and technical colleges in China prioritise practical training. To achieve this, government collaborates with industry leaders and innovative institutions, ensuring students receive real-world experience and guidance. Another common practice in China is the creation of corporate clubs in collaboration with vocational colleges and enterprises. Companies such as Siemens, Schneider, PayPal, Huawei, and ZTE have established such clubs, which facilitate communication between colleges, enterprises, and universities. These organisations are central in fostering closer connections between education, industry, and innovation.

Engineering talent is in high demand in China, prompting vocational colleges to address the needs of enterprises through practice-oriented education and the integration of industry into the learning process. Research groups are established within colleges and enterprises to collaborate on scientific projects of mutual interest. In these projects, enterprise leaders and engineers act as mentors, conducting training sessions that help future engineers acquire essential professional qualities and skills. The creation of these research clubs brings an innovative dimension to partnerships between colleges and enterprises. Entrepreneurial clubs not only reserve human resources for businesses but also provide a platform for enterprises and institutions to explore a dual education mechanism. Simultaneously, they offer vocational colleges opportunities to establish talent development programs. According to R. Guoyuan (2025), the jointly established innovation and research centres serve as crucial platforms for students to develop practical skills and an innovative mindset, facilitating the transformation of scientific research into business opportunities.

Internships are a key component of vocational education in China. Most colleges require students to complete at least 10 months of internships, spread across three phases throughout their studies. The first phase introduces students to the fundamentals of workplace structure, organisation, and operation. The second phase, typically lasting three months, immerses students in basic production processes and workplace scenarios, during which they act as assistant engineers to gain in-depth practical experience (Stewart, 2015). Key trends in the development of professional skills in Chinese technical colleges include:

- integration of innovative pedagogical methods. Techniques such as problem-based learning, team projects, and experiential learning foster professional thinking among future engineers (Schmidtke & Chen, 2012);
- interdisciplinary educational approaches. Adapting knowledge from diverse fields, including interdisciplinary ones, enhances creativity and logical thinking in developing professional qualities for future engineers (Qu, 2024);
- application of new technologies in education. The integration of online virtual platforms, artificial intelligence, and other technologies enhances creativity in engineering, improves knowledge retention, and enables more effective experiments. These technologies also render learning more engaging, offering opportunities for cultural exchange among students from different countries. Virtual platforms enable experiments and research in simulated environments, providing creative solutions without the

limitations of physical resources. Interactive materials encourage active student participation, making learning more dynamic (Chen *et al.*, 2022; Bailey *et al.*, 2024).

The implementation of a dual education approach in training engineers is supported by a robust regulatory framework. The Chinese government has adopted education strategies that encourage students to pursue technical disciplines (MOHRSS, 2012; Vocational Education Law, 2022). Additionally, the government has developed assistance packages for polytechnic colleges that integrate dual principles into their educational processes (The State Council, 2022; 2023). Consequently, the implementation of the dual education system involves the combined efforts of the government, enterprises, and vocational colleges.

Recommendations for improving the quality of training of engineering specialists in China

The training of engineering specialists in Chinese educational institutions should be based on current trends and government initiatives aimed at improving the quality of education and its compliance with the requirements of an innovative economy. The study determined that modern engineering students must first master all the components of professional culture. To train engineers for high-tech industries and the international market, China needs to further transform professional engineering education, addressing the issue of passive learning and the lack of intercultural communication. Although active learning approaches such as dual education were widely studied around the world, their application in China is still in its early stages. In addition, according to A. Koty (2022), Sino-foreign joint education programs, which are designed as a core in promoting intercultural communication in China's engineering education, are usually implemented inefficiently due to the improper integration of active learning methods and the lack of an effective assessment system. The following recommendations can be used to achieve the above:

1. Strengthen scientific education from an early age: it is necessary for primary and secondary schools to strengthen scientific education to stimulate interest in engineering disciplines by introducing more comprehensive scientific programs, improving the qualifications of teachers, and integrating scientific resources into the educational process.

2. Strengthen cooperation between vocational colleges and industry: the integration of education with production is a key element of engineering training. Educational institutions actively cooperate with enterprises to provide students with practical experience and relevant knowledge that meet the needs of the labour market. However, the results of the study demonstrated that the current government policy is uncertain and cannot sufficiently influence the process of interaction between enterprises and colleges. Therefore, the complexity of the relationship between vocational technical colleges and enterprises requires further clarification of rights and obligations in the form of a strict legal framework and a system of rules. At present, the obligations of enterprises in conducting practical classes, their quantity and quality are not regulated, and there is no control over this area. Therefore, it is necessary to regulate this issue both at the legislative level and at the level of college-enterprise interaction. In addition, vocational training in the workplace must be prescribed in the form of regulations to make it more useful for both students and employers. It is necessary to create mechanisms and institutions that effectively stimulate and mobilise the active participation of practitioners. It is worth codifying the obligations of enterprises to participate in vocational education based on colleges. The process of institutional reform will transform a new management system.

3. Use of modern technologies in education: to increase the efficiency of the educational process and prepare students for work in a modern technological environment, it is worth introducing digital technologies and innovative methods into the educational process.

4. International cooperation: joint programs with foreign universities and student exchange allow to adopt best practices and improve the quality of engineering education.

5. Training of highly qualified teachers: it is necessary to provide vocational education institutions with qualified personnel with scientific degrees in the field of engineering and technology, as this is an important factor for the quality training of students. In this case, it is worth not only conducting courses to improve the qualifications of teachers but also involving them in practical training in production.

6. Institutional reform of vocational education: the author believes that the essence of institutional reform of this area of education is the promotion of decentralisation of management through system mechanisms, restructure the organisational functions of educational institutions, clarify the functional roles and responsibilities of each participant in the educational process, and introduce innovative working mechanisms into the college-enterprise relationship.

7. Increasing adaptability: vocational colleges need to quickly increase their adaptability in accordance with the establishment of a city-wide education-industry consortium, which will allow them to better participate in new practices.

8. Stimulating government policies: political incentives alone in the field of vocational education cannot improve the reputation and attractiveness of the engineering profession in China. Therefore, the author believes that it is necessary to combine policies to improve the attitude towards qualified workers, form a decent level of wages for engineering majors, and implement social propaganda measures in relation to vocational education.

9. Establishing a close connection between the socio-economic system and vocational education: it is necessary to coordinate the specialisation of the college with the industry, combine curricula and professional standards, coordinate the learning process with the production process, and provide an academic diploma together with a professional certificate.

In conclusion, enhancing engineering education in China requires a multi-pronged approach encompassing strengthened early scientific education, deeper industry-academia collaboration through a clear legal framework and incentivised participation, integration of modern technologies, expanded international cooperation, highly qualified teaching staff, institutional reforms promoting decentralisation and adaptability, and stimulating government policies that improve the social standing and financial rewards of the engineering profession. These combined efforts aim to address current shortcomings in passive learning and intercultural communication, ultimately aligning engineering education with the demands of a rapidly evolving, innovation-driven economy.

Conclusions

The study concluded that China addresses the need to develop high-quality technical education to ensure their technological leadership in the world. The main strategic areas that currently require engineering talents are manufacturing, infrastructure development, telecommunications and electronics, artificial intelligence, renewable energy. Engineering talents in these areas come mainly from higher education institutions, but vocational technical education is becoming increasingly relevant. The main vector of the development of vocational education in China is the shift in emphasis from obtaining appropriate qualifications to the formation of professional skills and readiness to begin performing professional duties immediately after graduation.

The study established that the main problems in the development of vocational education are passivity of the educational process, insufficient level of practical classes in training, lack of image of vocational colleges and popularity of the profession in society, the closedness of the socio-economic system of China. The research has shown that the Chinese government, being aware of the importance of vocational education and the role of engineering specialties in the development of the country's economy, has

carried out several reforms in the field of vocational education, including encouraging cooperation between colleges and enterprises. The main pedagogical conditions that are currently formed in most vocational colleges in China are the following: modular and project-based learning, student-centeredness, practical training, innovative and digital technologies, interdisciplinary courses, research clubs, trainings. The study determined that Chinese dual system of education vocational technical education is being reformed through the interdisciplinary and student-centred approach.

The study provided the following recommendations to improve the conditions for training engineering specialties: strengthen scientific education from an early age, strengthen cooperation between vocational colleges and industry, including in terms of legislatively establishing the rights and obligations of enterprises and colleges in training future engineers in the form of a strict legal framework; develop regulations for practical classes, expand the boundaries of international cooperation, complete the institutional reform of vocational education; involve teachers in practical training at the enterprise; increase the level of social propaganda; coordinate the specialisation of colleges and industry. Further research could explore the long-term impact of implemented reforms on the quality of engineering graduates and their success in the workforce. It would also be valuable to conduct comparative studies with other countries to benchmark best practices in vocational engineering education and identify areas for further improvement in the Chinese context. Additionally, investigating the effectiveness of specific pedagogical approaches, such as modular and project-based learning, in fostering practical skills and addressing passive learning would be beneficial.

Acknowledgements

None.

Conflict of Interest

None.

References

[1] Bailey, W., Lavender, K., Youde, A., & Jiao, J. (2024). Experiences from great vocational education policy change in China – a teacher perspective. *International Journal of Training Research*, 22(1), 87-104. doi: 10.1080/14480220.2024.2332350.

[2] Barak, M., Ginzburg, T., & Erduran, S. (2024). Nature of engineering. *Science & Education*, 33, 679-697. doi: 10.1007/s11191-022-00402-7.

[3] Belt and Road Initiative (BRI). (2023). Retrieved from https://surl.li/kkqugw.

[4] Chen, P., Schmidtke, C., & Jin, X. (2024). Chinese technical and vocational education and training, skill formation, and national development: A systematic review of educational policies. *Vocation, Technology & Education*, 1(3), article number 677. doi: 10.54844/vte.2024.0677.

[5] Chinese Society of Engineers (CSE). (n.d.). *Regulations of the Chinese Society of Engineers*. Retrieved from https://english.cast-cse.org.cn/cms/lhtgc.htm.

[6] Fedoreiko, V., Horbatiuk, R., Zamora, Ya., & Zahorodnii, R. (2022). Formation of professional competences of future bachelors of vocational education in the process of dual training. *Professional Education: Methodology, Theory and Technologies*, 8(1), 246-261. doi: 10.31470/2415-3729-2022-15-246-261.

[7] Guo, H., & Pilz, M. (2020). A comparative study of teaching and learning in German and Chinese vocational education and training schools: A classroom observation study. *Research in Comparative & International Education*, 15(4), 391-413. doi: 10.1177/1745499920959150.

[8] Guoyuan, R. (2025). Functioning and development of higher vocational colleges in China: Innovation, integration, adaptability to modern challenges. *Bulletin of Science and Education*, 12(30), 1033-1048. doi: 10.52058/2786-6165-2024-12(30)-1033-1048.

[9] Hao, T., & Pilz, M. (2021). Attractiveness of VET in China: A study on secondary vocational students and their parents. *Journal of Education & Work*, 34(4), 472-487. doi: 10.1080/13639080.2021.1946492.

[10] Koty, A.C. (2022). *Vocational education in China: New law promotes sector's growth*. Retrieved from https://www.china-briefing.com/news/vocational-education-in-china-new-law-promotes-sectors-growth/.

[11] Liu, X., Ji, X., Zhang, Y., & Gao, W. (2023). Professional identity and career adaptability among Chinese engineering students: The mediating role of learning engagement. *Behavioral Sciences*, 13(6), article number 480. doi: 10.3390/bs13060480.

[12] Ministry of Education of the People's Republic of China (MOE). (2023a). *Notice of the Office of the Ministry of Education on accelerating the reform of key tasks in the construction of a modern vocational education system*. Retrieved from http://www.moe.gov.cn/srcsite/A07/zcs_zhgg/202307/t20230717_1069319.html.

[13] Ministry of Education of the People's Republic of China (MOE). (2023b). *China to further promote the Double First-Class Initiative*. Retrieved from http://en.moe.gov.cn/news/press_releases/202203/t20220301_603547.html.

[14] Ministry of Human Resources and Social Security of the People's Republic of China (MOHRSS). (2012). *Opinions on expanding the scope of the tuition-free policy for secondary vocational education and further improving the national scholarship system*. Retrieved from https://www.mohrss.gov.cn/wap/zc/zcwj/202002/t20200210_359254.html#.

[15] Munkholm & Zhang Consulting. (2024). *China's engineering capabilities and workforce 2024*. Retrieved from https://surl.li/tvwkdq.

[16] Neves, R.M., Lima, R.M., & Mesquita, D. (2021). Teacher competences for active learning in engineering education. *Sustainability*, 13(16), article number 9231. doi: 10.3390/su13169231.

[17] Qu, Z. (2024). School education and engineering practices: Dual pathways to cultivating excellent engineers. *Engineering Education Review*, 2(1), 16-18. doi: 10.54844/eer.2024.0517.

[18] Schmidtke, C., & Chen, P. (2012). Philosophy of vocational education in China: A historical overview. *Journal of Philosophy of Education*, 46(3), 432-448. doi: 10.1111/j.1467-9752.2012.00859.x.

[19] Stewart, V. (2015). *Made in China: Challenge and innovation in China's vocational education and training system: International comparative study of leading vocational education systems*. Retrieved from https://files.eric.ed.gov/fulltext/ED556319.pdf.

[20] The State Council of the People's Republic of China. (2022). *China issues guideline on advancing vocational education reform*. Retrieved from https://english.www.gov.cn/policies/latestreleases/202212/21/content_WS63a30e49c6d0a757729e4a63.html.

[21] The State Council of the People's Republic of China. (2023). *Opinions on deepening the reform of the construction of a modern vocational education system*. Retrieved from https://www.gov.cn/gongbao/content/2023/content_5736711.htm.

[22] The State Council of the People's Republic of China. (2025). *China unveils blueprint for building strong education system by 2035*. Retrieved from https://surl.li/bucyqx.

[23] Vocational Education Law of the People's Republic of China. (2022, April). Retrieved from http://en.npc.gov.cn.cdurl.cn/2022-04/20/c_909970.htm#:~:text=Article%2068%20This%20Law%20shall,as%20of%20May%201%2C%202022.

[24] Wang, F. (2020). A comparative study of Chinese and American engineering education professional certification standards. In *Proceedings of the International conference on education, economics and information management (ICEEIM 2019)* (pp. 25-31). Wuhan: Atlantis Press. doi: 10.2991/assehr.k.200401.008.

[25] Wei, S., Zheng, L., & Ohland, M. (2022). New engineering education initiative of China: A policy debrief. In *Proceedings of the ASEE Annual Conference & Exposition* (paper ID 36441). Minneapolis: American Society for Engineering Education. doi: 10.18260/1-2--40391.

[26] Wheelahan, L., & Moodie, G. (2017). Vocational education qualifications' roles in pathways to work in liberal market economies. *Journal of Vocational Education & Training*, 69(1), 10-27. doi: 10.1080/13636820.2016.1275031.

[27] Zhuang, T., & Xu, X. (2018). "New engineering education" in Chinese higher education: Prospects and challenges. *Tuning Journal for Higher Education*, 6(1), 69-109. doi: 10.18543/tjhe-6(1)-2018pp69-109.

Підготовка майбутніх інженерів у закладах професійної освіти Китаю

Гао Чжен

Аспірант
Національний університет біоресурсів і природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна
https://orcid.org/0009-0007-7991-6394

Анотація. Якісна інженерна освіта є ключовим чинником забезпечення технологічного лідерства та економічного розвитку провідних країн світу, зокрема Китаю. У статті розглянуто сучасні підходи до інноваційного розвитку інженерної освіти, орієнтовані на адаптацію до викликів нової економіки. Особливу увагу приділено ініціативі дуальної освіти, яка передбачає інтеграцію теоретичного навчання з практичним досвідом. Такий підхід готує висококваліфікованих інженерів, здатних відповідати вимогам інноваційного розвитку та впроваджувати новаторські рішення. Метою дослідження було визначення педагогічних умов та особливостей підготовки майбутніх інженерів у професійних закладах Китаю. У роботі використано методи аналізу, синтезу та узагальнення для систематизації отриманих результатів. Проаналізовано ключові проблеми професійної підготовки, зокрема пасивність навчального процесу, обмежені можливості міжкультурної комунікації та недостатній рівень впровадження проектного навчання. Особливу увагу приділено ролі співпраці з підприємствами у формуванні практичних навичок студентів. У статті виокремлено основні педагогічні умови, що сприяють ефективній підготовці інженерних кадрів: використання модульного навчання, впровадження інформаційно-комунікаційних технологій, акцент на самостійне навчання студентів і розширення можливостей практичної підготовки. Розглянуто перспективи міждисциплінарного підходу в навчальних програмах, що сприяє розвитку творчого та критичного мислення. Показано, що залучення міжнародних партнерів до навчального процесу може значно посилити якість освіти. Практична цінність дослідження полягає у визначенні шляхів удосконалення підготовки інженерів у професійних технічних коледжах. Отримані результати можуть бути використані для розробки освітніх програм, які поєднують теорію з практикою та сприяють підвищенню конкурентоспроможності випускників на міжнародному ринку праці

Ключові слова: інженери; дуальна освіта; професійні коледжі; технічна освіта; проєктне навчання