

Research on the Factors Affecting the Training of High-level Technical and Skilled Talents in Colleges and Universities

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Abstract: The key factors affecting the cultivation of high-level technical skills include policy, education system, enterprise, and social and personal factors. By analyzing the current situation and experience at home and abroad, the paper puts forward the strategies for improving the policy system, optimizing the education system, strengthening school-enterprise cooperation, improving social awareness, and improving personal quality. The study believes that these strategies will help to improve the quality of highly skilled personnel and promote economic and social development.

Keywords: High-level technical skilled personnel; Personnel training; Education system; School-enterprise cooperation

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1. Introduction

The cultivation of high-level technical and skilled talents is an important support for the current scientific and technological development and economic transformation. With the acceleration of scientific and technological progress and the adjustment of industrial structure, the demand for talents with excellent technical ability and innovative spirit is increasing day by day. Through systematic analysis and comparative research, the key factors affecting the training of high-level technical talents are discussed, and corresponding policy suggestions and strategic measures are put forward to provide theoretical support and practical guidance for the improvement of the training quality of highly skilled talents in China.

2. The current situation of cultivating high-level technical and skilled talents

2.1. Definition and classification of high-level technical and skilled talents

In the background of the rapid development of global technology, the cultivation of high-level technical and skilled personnel is particularly critical and urgent. High-level technical and skilled talents are usually defined as those with deep expertise and skills in a specific field, who can independently complete complex technical

tasks and can innovate. According to their different professional fields and skill requirements, these kinds of talents can be further divided into engineering and technical talents, information technology talents, biomedical technology talents, and other categories ^[1]. Engineering and technical personnel mainly cover engineering design, process manufacturing, and other fields, while information technology personnel are concentrated in the forefront of computer science, network security, and other technologies, while biomedical technical personnel are involved in highly specialized fields such as biological engineering and drug research and development. The cultivation of these talents needs not only a solid theoretical foundation but also a practical ability closely combined with practical application, as well as a continuous innovation consciousness and the ability to solve problems ^[2].

2.2. The current situation of the training of high-level technical and skilled personnel in China

The training of high-level technical talents in China is remarkable, so it is an important topic in the current national development. Through a series of policy documents and plans, the Chinese government has clarified the strategic importance and long-term planning for the training of highly skilled personnel. Under the guidance of the policy, higher education institutions have deepened and innovated in the curriculum setting, teaching methods, practical links, and other aspects, focusing on improving the students' practical operation ability and the ability to solve practical problems ^[3]. The rapid development of higher vocational education also provides a new path and platform for the cultivation of technical talents. Through school-enterprise cooperation, industrial practice, and other ways, higher vocational colleges enable students to master the required skills in practice and integrate with the market demand, effectively improving the employment competitiveness of graduates. In addition, with the promotion of scientific and technological innovation and industrial upgrading, the need for highly skilled talents is becoming more urgent. At the policy level, the state has supported the development of science and technology enterprises and high-tech industries and promoted the training and absorption of highly skilled personnel.

2.3. The current situation and experience of the training of international high-level technical and skilled talents

The international training of high-level technical and skilled talents is marked by diversity and innovation. Germany's "dual system" education integrates classroom learning with practical experience in enterprises, enhancing students' practical skills and job competitiveness. This model is popular, with about 60% of German youth opting for it, contributing to a low youth unemployment rate of 6.1% in 2019, well below the EU average of 11.2%. It emphasizes both technical proficiency and problem-solving abilities. Japan's "industry-university cooperation" model ensures educational relevance to market needs through strong partnerships between universities and enterprises. This collaboration fosters skilled professionals aligned with industry demands, driving scientific and industrial advancement ^[4].

Conversely, US higher education prioritizes cultivating students' innovation and independent learning abilities through participation in research and practical projects. The US also leads in research and development investment, with 2.8% of GDP allocated in 2018, bolstering innovation and talent development at universities. International academic exchanges further enrich talent training by facilitating resource sharing and global cooperation in technological innovation. These exchanges strengthen collaboration between countries, enhancing educational outcomes and fostering a global talent pool adept at meeting international challenges.

3. Factors affecting the training of high-level technical and skilled talents

3.1. Policy factors

Policy profoundly shapes the development of highly skilled personnel. Government policies, including laws, regulations, and strategic documents like the Outline of the National Medium-and Long-term Talent Development Plan (2010–2020), outline strategic goals and support systems for higher education and vocational training. These policies define objectives, provide guidance, and enhance China's training system for highly skilled personnel.

Financial policies are pivotal, influencing resource allocation and education quality. Government initiatives such as financial aid, scholarships, and grants bolster university resources and student support, fostering academic research and innovation. This enhances the appeal and competitiveness of training highly skilled individuals ^[5]. Moreover, policies facilitate university-enterprise cooperation, integrating industry, academia, and research. They also promote international exchanges, offering expansive platforms and practical opportunities for talent development.

However, China's policies for training highly skilled personnel require enhanced focus, operational efficiency, and system optimization to ensure effective implementation and impact. Strengthening policy coherence and effectiveness will further advance China's capabilities in developing a highly skilled workforce.

3.2. Education system factors

Curriculum setting and teaching methods directly determine the depth and breadth of students' technical skills learning. Higher education institutions and vocational education colleges ensure students' comprehensive development in theoretical knowledge and practical operation skills. For example, through laboratory training, practice, and other teaching arrangements, students can accumulate experience in simulated real work scenarios, master advanced technology and operation skills, and enhance their competitiveness and adaptability in their careers. Modern teaching methods, such as problem-oriented learning, project-driven learning, and so on, emphasize students' independent learning and teamwork ability and cultivate students' ability to solve practical problems and innovative thinking ^[6]. At the same time, diversified evaluation systems, such as comprehensive assessments, internship reports, and so on, can comprehensively evaluate students' learning results and ability levels.

The internationalization and openness of the education system are also an important guarantee for cultivating highly skilled personnel. Through international cooperation programs, student exchange programs, and so on, students can be exposed to international advanced technology and management concepts, expand their horizons, enhance cross-cultural communication skills, and lay a foundation for their career development in the context of globalization ^[7]. However, the education system also faces challenges in the process of cultivating highly skilled talents, such as the imbalance of educational resources and the unreasonable structure of teachers. The government and education departments need to further strengthen investment and management, optimize the allocation of educational resources, and ensure that the education system can better meet the needs of social development for highly skilled personnel ^[8].

3.3. Enterprise factors

As the main body of market demand and the main undertaker of technological innovation, enterprises directly participate in the whole process of talent training. Through the establishment of school-enterprise cooperation with universities and vocational education institutions, enterprises can effectively participate in course design, internship arrangements, and skills training to ensure that students acquire skills and knowledge closely connected with market needs. This close school-enterprise cooperation not only promotes the improvement of

education quality but also enhances students' application ability and employment competitiveness in practice. Many advanced enterprises set up research and development centers, laboratories, and other research platforms to provide innovative research opportunities for highly skilled talents and practice and encourage students to show their talents in technological innovation and solving practical problems. At the same time, enterprises also provide compensation and welfare, career development channels, and other attractive measures to attract outstanding talents to join and maintain the stable and efficient operation of the talent team ^[9]. However, enterprise factors also face challenges in the training of highly skilled personnel, such as the mismatch between enterprise needs and educational resources, and the high cost of enterprise training, which requires the joint efforts of the government and enterprises to promote the close connection between education and market demand.

3.4. Social factors

The increasing social demand for technical and skilled talents shapes the education system by necessitating updates in curriculum and teaching methods. As science, technology, and industry evolve, there is a growing need for individuals with advanced technological and innovative skills. This demand drives educational institutions to adapt their offerings and encourages increased government and corporate investment in training highly skilled personnel to meet market needs.

The societal recognition and prestige associated with technical talents significantly influence students' and parents' career choices and educational investments. Positive perceptions of lucrative job prospects and career advancement in technical fields inspire more students to pursue related majors. Consequently, there is heightened attention and investment in technical education within the broader education system ^[10].

To further promote technical skills, the society organizes skills competitions and recognizes outstanding technical personnel, showcasing successful career paths to inspire students and foster their enthusiasm for skill development. However, social factors present challenges, such as insufficient recognition of technical labor and an overemphasis on non-technical occupations. These factors can influence students' career preferences and choices. To address these challenges, comprehensive efforts across society are needed. This includes increasing public awareness and appreciation of technical labor through education and advocacy efforts. By improving understanding and respect for technical skills, society can create a conducive environment that supports the cultivation of more highly skilled technical talent.

3.5. Personal factors

Personal learning attitude and abilities are pivotal in shaping one's growth and development in technology. Individuals who cultivate independent learning habits and embrace continuous improvement can effectively navigate rapid technological changes while enhancing their professional knowledge and skills. Having clear career goals enables individuals to pursue targeted learning paths, laying a robust foundation for career advancement. Innovation and problem-solving prowess are hallmarks of highly skilled professionals. Engaging in scientific research projects and internships hones innovative thinking and practical abilities, preparing individuals to excel in their fields.

However, individual challenges include disparities in learning conditions and access to resources, which can impact exposure to advanced technologies and knowledge. Personal motivation and persistence are essential for sustained technical skill development, requiring individuals to maintain resilience and a proactive learning mindset amid obstacles. Personal factors not only drive individual progress but also necessitate support from society, families, and schools. Society must ensure equitable educational opportunities and conducive

learning environments to empower individuals to reach their full potential. Families and schools play crucial roles in fostering a positive life and career outlook, cultivating psychological resilience, and enhancing social adaptability, nurturing future leaders in science and technology.

4. Strategy to improve the quality of high-level technical talents

4.1. Improve the policy system

The effectiveness of higher education and vocational training is directly impacted by the improvement of the policy system. To enhance this, the government must clarify strategic goals and development paths for training highly skilled personnel through clear talent development plans and strategic documents. These documents should encompass the entire skill training process and anticipate changes in market demand and technological innovation trends. This foresight ensures policies are both forward-looking and targeted.

The policy system should prioritize mobilizing enthusiasm across universities, research institutions, and enterprises. Incentive policies, scholarships, grants, and research fund support can foster cooperation among these entities, driving deeper talent development. Particularly in school-enterprise collaboration, policies could offer tax incentives and project funding to encourage enterprise involvement in education, training, and practical experiences for students.

Moreover, the government should establish a robust supervision and evaluation mechanism to regularly assess and adjust policies for training highly skilled personnel. Challenges such as inadequate policy implementation and lengthy policy formulation cycles need addressing through improved coordination, communication, and agile policy formulation by government departments. A refined policy system not only enhances the quality of technical personnel training but also promotes national scientific and technological innovation and economic development. It requires collaboration among government, academia, enterprises, and society to ensure effective policy formulation, implementation, and evaluation, thereby fostering the cultivation of excellent technical personnel.

4.2. Optimize the education system

Universities must focus on curriculum design and teaching methods that align closely with market demand to optimize the education system. By updating the curriculum with the latest technical theories and practical applications, students can acquire cutting-edge skills and knowledge. Diverse teaching methods like problem-based learning, case studies, and practical training foster critical thinking, innovation, and teamwork skills, preparing students to tackle real-world challenges. Teachers play a pivotal role in education quality and student development. Hence, enhancing teachers' academic qualifications, teaching skills, and involvement in research projects and practical activities boost their enthusiasm and innovation, thereby improving overall education quality and student outcomes.

Personalized student development and comprehensive education are also crucial. Elective courses, internships, discipline-specific competitions, and other initiatives cater to diverse learning needs, fostering professional ethics and social responsibility. This approach ensures students not only gain technical expertise but also adaptability to meet future societal demands. Furthermore, optimizing the education system requires increased government investment, resource allocation, and systemic reforms. These efforts aim to ensure that educational resources and reforms benefit a broader spectrum of students and institutions, as shown in **Table 1**.

Table 1. Countermeasures of education system optimization

Take measures to improve the education system	Concrete content	Expected effect
Course offered	Adjust and update the curriculum system, and introduce the latest technical theory and practical application	Students should master cutting-edge and practical skills
Teaching method	Various teaching methods such as problem-driven learning, case teaching, experiment, and practical training are adopted	Cultivate students' critical thinking, innovation ability, and team spirit
Teachers' professional quality and teaching ability have been improved	Improve teachers' academic level and teaching skills, and support teachers in participating in scientific research projects and practical activities	Improve the quality of education and students' comprehensive quality
Students' personalized development and comprehensive quality education	Open elective courses, provide practice and training opportunities, carry out discipline competitions and other forms	To meet students' personalized learning needs, to cultivate professional ethics and social responsibility
Investment from the government and the educational administration department	Increase investment, optimize the allocation of resources, and promote the reform of the education system and mechanism	Ensure that educational resources and the fruits of the reform benefit more students and educational institutions

4.3. Strengthen school-enterprise cooperation

School-enterprise cooperation effectively bridges educational institutions and enterprises, enhancing technology application and practical experience. By forging long-term partnerships with industry leaders, educational institutions gain timely insights into technical needs and market trends, adapting teaching content and methods to ensure education remains effective and forward-looking. Enterprises benefit by leveraging campus resources for developing new technologies and testing products, fostering both technological innovation and talent development. This collaboration facilitates real-world learning through practical experience and direct industry communication, equipping students with problem-solving skills and market adaptability. Such immersive experiences boost students' confidence, professional acumen, and career readiness.

Moreover, school-enterprise partnerships offer students broader career platforms and employment prospects. Mentorship programs and professional skills training help students integrate seamlessly into industry roles post-graduation, ensuring a smooth transition to professional life. Establishing sustainable cooperation mechanisms and fostering mutual trust among stakeholders are crucial. Government support through policies and resources encourages enterprise involvement, driving deeper integration of enterprises, universities, and research institutes. This collaborative approach continuously enhances and updates the skilled personnel training system.

4.4. Improve social awareness

Social recognition significantly impacts the professional standing and societal value of technical talents. As technology advances and industrial structures evolve, the demand for skilled individuals with advanced technological and innovative capabilities grows, leading to increased societal appreciation of technical labor. Expanding science and technology education and vocational training increases public understanding and recognition of technical professions, challenging traditional perceptions and elevating their social status. Publicity campaigns and media coverage play a crucial role in showcasing technological innovations and applications, highlighting the achievements of successful technical experts to inspire young people to pursue careers in technology.

Deepening collaboration among industry, universities, and research institutes is essential to effectively transform and apply scientific discoveries. Establishing platforms for innovation and promoting technological achievements through exhibitions and promotional activities accelerates the transition of research into practical applications, bolstering the societal impact and innovation capacity of technical professionals. Concerted efforts across multiple sectors can raise public awareness, cultivate globally competitive skilled personnel, and drive China's economic transformation, social progress, and technological advancement.

4.5. Improve personal quality

Personal quality encompasses professional knowledge, comprehensive abilities, and professional demeanor. In terms of knowledge, individuals must continuously deepen their expertise and stay abreast of the latest technological advancements and industry trends to meet evolving market demands. Developing comprehensive abilities involves cultivating critical thinking, innovation, and problem-solving skills through interdisciplinary learning and practical experience. This approach enhances overall competitiveness and personal growth. Professional demeanor includes effective communication, teamwork, and ethical conduct, crucial for navigating dynamic work environments and contributing value to enterprises and society. Improving personal quality requires personalized development and holistic enhancement. Through tailored development plans, participation in academic exchanges, and practical activities, individuals uncover and nurture their potential, broaden their perspectives, and build confidence, laying a robust foundation for future career paths.

Furthermore, enhancing personal quality hinges on strengthening self-management and learning capabilities. Establishing structured learning and career plans enables continuous improvement and adaptation to future societal and career demands. Creating a supportive environment embraced by family, educational institutions, and society is essential. This environment fosters optimal growth and learning systems, facilitating individuals in realizing their full potential and maximizing their contributions to society.

5. Conclusion

Factors influencing the development of high-level technical and skilled talents encompass policy, education systems, enterprises, society, and individuals. Strategic recommendations for these factors aim to enhance training quality, and market adaptability of skilled personnel, and drive sustainable economic restructuring and social progress. Collaborative efforts among government, educational institutions, enterprises, and society are crucial. Implementation of relevant policies and measures is essential to create a conducive environment and favorable conditions for nurturing globally competitive skilled personnel in technology.

Disclosure statement

The authors declare no conflict of interest.

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