

Reevaluating the Value of Science and Technology Ethics Education in Contemporary Higher Education

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Abstract:

The accelerating evolution of scientific and industrial revolutions presents substantial benefits, significant uncertainties, and formidable ethical challenges to global society. This study investigates trends and characteristics in the pedagogy of science and technology ethics, aiming to highlight the critical role of such education in higher education during this new era. By employing bibliometric analysis, this study examines a corpus of 422 publications, focusing on themes such as scientific and technological innovation, ethical norms in science and technology, the development of a science and technology powerhouse, ethics education in science and technology, and the concept of “technology for good.” As the central hub where education, scientific progress, and talent cultivation converge, universities bear the vital responsibility of shaping the next generation. Enhancing science and technology ethics education in these institutions is crucial for constructing a robust educational foundation and achieving self-reliance in advanced scientific and technological capabilities. In response to the ethical challenges and risks posed by rapid technological advancement, the systematic integration of science and technology ethics education within higher education in this new era represents a crucial, scientifically informed, and sustainable transformative endeavor. This initiative is essential for fostering a responsible and ethically conscious technological perspective among students.

Keywords: Higher Education; Science and Technology Ethics Education; Values

Introduction:

Science and technology ethics constitute the indispensable behavioral guidelines and value norms that must be adhered to in the conduct of scientific and technological activities (Xi,2019). Never before have science and technology so profoundly influenced the destiny of a nation and the well-being of its people as they do today. Consequently, ethics education in this domain has become a crucial component of undergraduate studies. Advanced technologies such as artificial intelligence, gene editing, big data analytics, quantum communication, facial recognition

systems, and ultra-high-definition video are developing at an unprecedented pace. Their applications have permeated every facet of human production and life, profoundly reshaping the global landscape of scientific and technological innovation (Wang &Yu,2024). However, this process is accompanied by a series of actual and potential ethical dilemmas. In this context, universities play a pivotal role in educating about the ethics of technology. They have a crucial responsibility to cultivate students' ethical

awareness in the fields of science and technology and to guide them in integrating ethical principles into their technological practices (Xiao,2022). This article focuses on three key aspects: a human-centered and character-building approach to education in technology ethics; an educational philosophy that emphasizes both tradition and innovation, alongside multidimensional integration; and the objective of fostering a strong nation through education for the benefit of its citizens. A people-centered focus anchors the direction of technological development to benefit humanity, while character development and talent cultivation establish the fundamental values of ethical awareness combined with innovative capacity. Upholding orthodoxy while fostering innovation aims to drive technological advancements within ethical boundaries, and multidimensional integration seeks to construct an interdisciplinary educational ecosystem. Building a strong nation through education serves as a strategic pillar for cultivating scientific and technological talent, alongside the inclusive value of benefiting all citizens, promoting educational equity, and narrowing the resource gap.

1. Humanistic And Ethics-Driven Educational Principles

1.1 People-Centered Values Orientation in Science and Technology Ethics

People's livelihood is the greatest politics (Xi,2022). As the main actors in society, humans continuously create abundant material and spiritual wealth through their engagement in practical interactions with the natural world. From a historical materialist perspective, science and technology are tools invented and created by people in the course of material production and daily life to serve their own needs. They can be fully integrated with the subject of practice, the object of practice, and the mediating factors of time, thereby promoting social progress and development. The continuous advancement of society is inseparable from the hard work and dedication of the people, and our endeavor is directed towards fulfilling the people's pursuit of a

better life. Therefore, the development of science and technology itself must also meet the people's expectations of sharing in its achievements, enabling them to enjoy higher-quality technological services and achieve the sharing of scientific and technological fruits (Chen,2023).

Science and technology ethics education in colleges and universities should adhere to a people-centered approach. In the context of colleges and universities, the term people primarily refers to students, teachers, and administrators, all of whom are integral to the development of these institutions. As one of the main actors in science and technology ethics education, university administrators should prioritize the development of the institution and its faculty and students. Anchoring institutional development strategies and capitalizing on unique strengths to formulate technology roadmaps can enhance the efficacy of research commercialization, thereby bolstering faculty and student fulfillment and contributing to the educational mission. Furthermore, adhering to the principles of higher education, advancing faculty development, emphasizing mentorship, addressing pedagogical needs, and reinforcing professional ethics and technological ethical awareness is crucial for preventing ethical breaches in science and technology. Establishing democratic governance mechanisms, coupled with regular evaluation and review processes, safeguards the rights and interests of faculty and students. Defining the boundaries of ethical conduct and refining institutional frameworks to address academic misconduct are crucial steps in cultivating a robust academic environment (Zhu,2018).

Teachers, as the core human resources in colleges and universities, play a pivotal role in science and technology ethics education. In implementation, it is necessary to tailor education to individual students' needs, adopting a diverse and comprehensive approach that integrates content and form, and unifies knowledge, emotion, will, and action. This should be achieved through

enlightening reason and moving emotions to promote education that penetrates the heart enters the mind, and guides behavior. It is important to guide students in harnessing their moral imagination, envisioning the consequences of ethical scenarios, and facilitating a transformation from spontaneous to conscious ethical action.

At the student level, since students are the mainstay of university operations, science and technology ethics education must prioritize safeguarding their interests as its starting point. In view of the maturity of contemporary college students' sense of social responsibility, it is crucial to stimulate their enthusiasm, especially to enhance the sense of identity among student party members and cadres. By leveraging the power of student organizations, we can guide them to participate in the practice of science and technology ethics education, enabling them to become both practitioners and beneficiaries of this education, thereby cultivating their moral character and willpower. Only by internalizing morality in the heart can it be externally manifested in action during moral decision-making, achieving the unity of knowledge and action.

1.2 Ethical Guidelines for Science and Technology Education Aimed at Fostering Virtue and Cultivating Talent

Fulfilling the goal of cultivating virtue and talent is the primary objective of higher education. Therefore, at the institutional level, universities should proactively create and construct educational scenarios conducive to science and technology ethics education, laying a solid foundation for specific educational components. Teaching practice activities carried out by teachers are, in themselves, a process through which teachers participate in the governance of science and technology ethics. In teaching, teachers can assist students in enhancing their academic moral cultivation. By adhering to the laws of teaching and educating people, they should impart knowledge with virtue, integrate ethics into their

specialized fields, and incorporate the concept of cultivating virtue and talent into the governance of science and technology ethics. This approach aims to strengthen students' ethical responsibilities, elevate their moral character, and reinforce management and guidance to prevent ethical cognitive biases, ultimately cultivating talents needed by society (Zhang,2013). At the same time, it is essential to strengthen the construction of teachers' scientific and technological ethics and morality, fostering good scientific and technological moral conduct. Governance by virtue is a fine tradition in Chinese culture. As promoters of scientific research, teachers must adhere to scientific principles when enjoying the honors of scientific research and internalize ethical responsibilities into their research endeavors. Furthermore, teachers should recognize their exemplary role and strive to be responsible researchers. They must uphold academic ethics, resist unhealthy trends, and achieve positive interactions with universities and society.

Conscientiously enhance teachers' educational standards, especially by effectively integrating the Chinese-contextualized and modernized Marxist thought on science and technology ethics into educational practices. It is necessary to have a clear understanding and explanation of the dialectical relationship between science and technology and ethics, that is, scientific and technological progress can drive the forward development of ethics and morality, and the continuous development of ethics and morality will, in turn, influence science and technology. Always maintain the professional ethics of patriotism, innovation, dedication and collaboration, and adhere to the professional integrity of modesty, prudence and innovation. Set an example by being a pioneer in guiding the formulation of science and technology ethics standards, the punishment of violations of science and technology ethics, and the harmonious interaction between teachers and students. At the same time, participate in and improve the

educational content and methods with a sense of ownership, and give full play to the role in value guidance, knowledge dissemination, cultural education, etc. so that all decisions of the school are more scientific and reasonable, and truly achieve collaborative education (Hu,2022).

2. Educational Philosophy Emphasizing the Upholding of Positive Values and the Promotion of Multi-Faceted Integration.

2.1 Upholding Righteousness and Striving for Goodness, Cultivating Talents Inclined Toward the Good of Science and Technology.

In the new era, science and technology ethics serves as behavioral guidelines regulating human technological activities from a moral perspective. Upholding righteousness implies that talents should firmly adhere to the justice of science and technology ethics and pursue the positive orientation of technological applications. Striving for goodness is both the guiding objective of technological activities and the normative principle for technological applications. Issues such as the life ethics problems triggered by cloning technology and the human rights infringement issues caused by big data technology indicate that the freedom of scientific and technological activities and their applications cannot be boundless and unlimited (He & Li,2021). To determine the scope of technological freedom and identify the boundaries of techno-ethics, it is necessary to return to the original intention and starting point of technological development. Technology originated as an endeavor aimed at benefiting humanity, with its core essence centered on people and its fundamental goal being to serve human welfare. Technological development that begins with humans' upholding righteousness as its starting point will inevitably return to a value orientation of striving for goodness in technological ethics in its future research scope, exploration fields, and development principles. Upholding principles does not mean being conservative and resistant to change, nor does innovation imply abandoning

rules and acting blindly. Upholding principles means adhering to the norms of science and technology ethics, following the trajectory of educational development, and respecting the laws governing global transformations and temporal progress. Innovation, on the other hand, involves exploring new pathways for science and technology ethics education and promoting high-quality development in higher education.

Therefore, it is necessary to clarify the objectives of science and technology ethics education in universities and grasp the direction of its advancement. It is also essential to define the talent cultivation goals and social impacts of science and technology ethics education. In teaching, it is important to guide students to dispel superstitions and blind worship, cultivate a spirit of daring to criticize, integrate criticism into scientific and technological practice, and promote the development of scientific theories. Science and technology ethics education in universities aims to shape college students' cultural concept of pursuing goodness in science and technology, strengthen their ethical responsibility in the field of science and technology, and cultivate young innovative talents who adhere to the principle of using science and technology for good purposes. Furthermore, through their ethical practices, it seeks to extend its influence to the entire society, thereby forming a new pattern of science and technology ethics governance characterized by multi-party collaboration and joint governance (Hu,2022).

2.2 Multi-dimensional Integration to Broaden the Connotation and Extension of Science and Technology Ethics Education

Science and technology ethics constitutes a multi-dimensional integrated system encompassing a wealth of content. In the current era of rapid technological advancement, the domains covered by science and technology ethics are also becoming increasingly broad. The scope of science and technology ethics encompasses the dual domains of value neutrality and value-

ladenness in technological development (Zhen & Tang,2022). Only when science and technology reach the pinnacle of ethical thinking can they effectively improve the conditions of human survival and development. This implies that science and technology ethics must at least achieve the triple value goals of safeguarding the ecosystem, building a harmonious society, and promoting the free and comprehensive development of individuals. Therefore, it is imperative that we clearly and thoroughly explain to young students both the positive and negative impacts of science and technology ethics. By doing so, we can better guide them to adhere to the principle that ethics should precede technological development, thereby minimizing the risk of science and technology becoming an unbridled force.

Education in responsibility ethics, focusing on the responsible agents. With the progression of time, responsibility ethics has increasingly become an ethical imperative for the coexistence and common prosperity of all humanity. As potential subjects of responsibility in the realm of science and technology ethics, young college students should be exposed to discussions on value conflicts and their resolution in science and technology ethics, particularly the balancing of technological benefits and risks in their educational curriculum. Only by enabling students to appropriately navigate conflicts between interests and values in technological development can responsibility ethics education in science and technology truly achieve its substantive objectives (Lu & Hu,2024).

The essence of science and technology embodies the ecological ethical relationship between humans and nature. With the rapid advancement of science and technology today, it has deeply integrated into various fields such as economy, politics, culture, society, and ecology, exerting profound influences on all aspects of society and also bringing about numerous crises and challenges. Therefore, science and technology ethics education should enable young college

students to comprehend and practice the sustainable development concept of using science and technology to protect nature and achieve symbiosis. Moreover, as an applied ethics, science and technology ethics must address ethical issues specific to various disciplines and fields, which serves as the foundation for constructing a comprehensive system of science and technology ethics education. The content of science and technology ethics education in universities should keep pace with the times and the frontiers of science and technology, encompassing various professional fields and technological categories. It should delve into in-depth analysis and discussion of current hot-button ethical issues in science and technology, tailoring teaching methods to individual students' needs, and promoting the integration of general science and technology ethics education with specialized education. This approach aims to cultivate both industry experts and responsible citizens, enhancing the public's capacity to engage in the construction of science and technology ethics.

3. Value Objective of Building a Strong Nation Through Education and Enriching the Populace

3.1 Integrating Superior Resources to Advance the Dream of a Strong Nation

The concept of "educational powerhouse" not only signifies a nation's strong educational capabilities but also embodies the profound meaning of promoting national prosperity through education. Technology has a profound impact on the development of education and needs to continuously lead educational reforms to align with the needs of the times and society (Xie,2023). In the information age driven by artificial intelligence, how to leverage intelligent technologies to promote high-quality education development, empower the construction of an educational powerhouse through technology, and provide support and momentum for Chinese-style modernization has become the core mission of educational reform in the new era. Given this, university science and technology ethics education

needs to leverage network technology to expand educational domains and enhance educational effectiveness, which is a key strategy for solving educational challenges. Universities should actively apply cutting-edge technologies such as big data to optimize the allocation of educational resources, innovate educational formats, and precisely improve educational capabilities, thereby laying a solid technological foundation for science and technology ethics governance.

Strengthening the construction of university technology information sharing platforms. By investigating the actual needs of teachers and students and leveraging technologies such as big data, learning analytics, and knowledge graphs, we can optimize the retrieval, processing, and delivery of digital educational resources based on teaching objectives, styles, and cognitive levels. This will enable intelligent provision of tailored resources, achieving an adaptive presentation where resources find people. At the same time, innovations such as the "Internet+" model and 5G technology have revolutionized information production and dissemination patterns, giving rise to a digital resource-sharing mechanism under the Internet mindset (Zhang,2013). By leveraging the advantages of the Internet to integrate high-quality educational resources, we can form a sustainable supply system for digital educational resources, promoting the comprehensive radiation and sharing of superior educational resources. This facilitates the online circulation of digital educational resources across regions, urban and rural areas, and schools, thereby fostering a more equitable and accessible educational landscape.

Improving the research project management platform. By mobilizing social forces and integrating school teaching and scientific research resources, we will establish a technology management platform with the participation of both teachers and students, providing them with convenient services. We will standardize the management of various scientific and technological programs and scientific fund databases, requiring registration in the scientific

research management system and the uploading of ethical materials related to research projects. This will effectively promote the supervision of educational and scientific research activities among university teachers and students, and strictly enforce the responsibilities of various governance entities in science and technology ethics education.

Promoting the application of new media technologies and constructing platforms for disseminating emerging scientific and technological information. For university teachers and students, new media platforms such as "online media" and "WeChat official accounts" have become important channels for accessing scientific and technological information. Leveraging the rapid dissemination capabilities of new media, we will establish comprehensive and three-dimensional science popularization platforms such as Weibo, WeChat official accounts, and short video platforms. By adopting a combination of text and audio formats, we will enhance the openness of emerging technological information, promote interaction and communication among university researchers, and strengthen their understanding of emerging technologies.

3.2 Strengthen the Talent Pool and Enrich the Knowledge of the Local Populace.

A country's strength in education aims to cultivate innovative talents capable of achieving self-reliance and self-improvement in science and technology, in order to adapt to the new round of scientific, technological, and industrial revolutions and meet the demands of reshaping the global economic and political landscape. Against this realistic backdrop, there is an urgent need for the transformation of talent cultivation and educational goals. In the realm of science and technology ethics education, emphasis should be placed on enhancing students' key competencies in the digital age, such as problem-solving, teamwork, critical thinking, as well as information, digital, and intelligence literacy. This

is essential for cultivating innovative talents who can contribute to the frontiers of global science and technology and address major national strategic needs. Meanwhile, education, as a subsystem of society, fundamentally operates within the constraints of a given society's political, economic, and cultural frameworks. On the one hand, its development is shaped by these external factors; on the other hand, education actively influences and contributes to the advancement of a society's political, economic, and cultural dimensions, thereby serving the overall development of these spheres (Sun,2024). As the highest level of education, its connection with regional, particularly rural, politics, economy, and culture is closer compared to basic education. The role it plays is more direct and evident, as it can serve regional economic and social development through high-level talent cultivation, scientific and technological innovation, and transformation.

The core value of modern education in promoting social equity is fully manifested in its service to regional development. Education is closely intertwined with society, and issues of social change and equity often find expression in the field of education (Fan,2022). Ensuring equal access to education for disadvantaged groups can create fair competition and upward mobility opportunities for the general public, thereby reducing social inequities. In the realm of higher education, expanding its scale and promoting its popularization can enhance the competitiveness of those without higher education in the labor market, thereby narrowing income gaps between social strata. Especially in the context of rural revitalization, colleges and universities admitting and cultivating rural students can aid in their social mobility and promote social equity.

Universities serve as hubs for highly qualified talents, where experts, scholars, as well as undergraduate, master's, and doctoral students can provide human capital and technical support for local development. Educational reforms have enabled universities to align their academic disciplines more closely with societal needs, with

agricultural and forestry universities and agriculture-related disciplines demonstrating significant advantages in serving rural revitalization efforts. Moreover, universities possess a strong inclination towards social service, and participating in regional development and rural revitalization initiatives can expand their operational scope, enhance their service capabilities, and secure additional resources.

Conclusion:

Universities are important entities in scientific and technological innovation and serve as a bridge for applying scientific research achievements to society. Ethics education in science and technology is an indispensable part of the talent cultivation process in universities. Effectively preventing and addressing issues related to science and technology ethics in universities, fostering a clean and upright research environment, comprehensively enhancing the quality of independent talent cultivation across various disciplines, and promoting the sustainable development of science and technology are pivotal to the success of the strategy of rejuvenating the country through science and education and the realization of the goal of building a modern socialist power. For ethics education in science and technology within universities, adhering to the educational principles of people-orientation and cultivating virtue in students, upholding integrity while fostering innovation, and embracing a multidimensional and integrated educational philosophy, all with the overarching value goals of building an educationally strong nation and enriching the lives of the people, constitute the fundamental value tenets for ethics education in science and technology in universities in the new era.

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Disclosure Statement

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