Establishing a Collaborative Education Mechanism between Industry Standards in Communication Systems and Ideological and Political Education

Zongjian Fan
College of Marxism, Xinjiang Normal University Urumqi, Urumqi 830000, Xinjiang, China
Corresponding author: Zongjian Fan (e-mail: 17707836251@163.com)

ABSTRACT This paper develops an integrated collaborative education mechanism that bridges industry standards in communication systems with ideological and political education (IPE) in private universities. The proposed framework incorporates curriculum synergy, faculty development, institutional management, and resource support to cultivate graduates who are both technically proficient and ideologically aware. Core courses in network security, 5G architecture, and IoT protocols are aligned with IPE principles, emphasizing ethical technology use, national digital sovereignty, and social responsibility. Cross-disciplinary teaching teams, mentorship programs, and structured assessment systems ensure that students acquire both technical competence and moral reasoning. The framework is particularly relevant for wireless communication networks, antenna-supported infrastructures, and digital systems where ethical and secure communication practices are critical. Empirical observations demonstrate enhanced student engagement, technical skill mastery, and ideological understanding, providing a replicable model for integrating technical education with ethical and political awareness in engineering disciplines.

INDEX TERMS communication systems, ideological and political education, collaborative education, antenna-supported networks

I. INTRODUCTION

IN the age of high-speed technology, the discipline of communication systems demands professionals who possess not only updated technical competence but also a solid ideological and political background [1]. This necessity for comprehensive education is mirrored in the many industry, where technical experts managing complex, global digital supply chains must pair their proficiency in secure communication protocols with a deep understanding of ethical production standards and compliance with international trade and labor regulations. The accelerated deployment of communication networks, including 5G, IoT, and successor technologies, necessitates that educational priorities shift toward holistic training, ensuring future graduates can effectively integrate technological proficiency with foundational ideological principles to navigate their increasing social, economic, and political impact. China's national education policy, particularly the policies introduced during the tenure of General Secretary Xi Jinping, emphasizes the integration of ideological and political education (IPE) into the whole of higher education. This necessitates the construction of an integrated educational mechanism that effectively bridges communication system industry standards with ideological and political training, thereby ensuring the cultivation of holistic graduates who possess both technical and ethical abilities. This model is highly applicable to the modern industry, where graduates must not only master the complex communication protocols for smart manufacturing and global logistics but also adhere strictly to ethical sourcing, labor laws, and intellectual property protection mandated by policy [2]. These communication standards are backed by theoretical models as well as technical standards of official international bodies, e.g., the International Telecommunication Union (ITU) and the Institute of Electrical and Electronics Engineers (IEEE), which publish internationally recognized industry standards that dictate system design and performance. For instance, the 3rd Generation Partnership Project (3GPP) defines the technical specifications for 5G New Radio (5G NR), including parameters that guide network capacity. While not an innovative contribution, citing a fundamental parameter, such as the minimum required spectral efficiency ($\eta_{\min}$), is essential because it represents a mandatory technical industry standard that all graduates must master.

$$\eta = \frac{R}{B} \quad [\mathrm{bits/s/Hz}] \tag{1}$$

The formula (1) defining spectral efficiency, or a specific performance requirement derived from it, is crucial for two reasons:

1) It is a non-negotiable compliance requirement for system design.
2) It directly supports the national strategic goals for high-capacity digital infrastructure deployment.

The inclusion of this basic technical concept explicitly defines the industry standard dimension of the collaborative education mechanism.

Furthermore, system deployment must adhere to strict security and policy mandates, such as the ITU-T X.805 standard, which provides a framework for cybersecurity management. A successful system must satisfy both the technical and compliance dimensions.

IPE, however, is meant to cultivate political awareness, social responsibility, and moral character of the students. Incorporating these values with technical education is part of the construction of professionals who not only master their vocation, but more so their national and human goals [3]. This comprehensive approach can be conceptualized through the T-Shaped Talent Model, which emphasizes deep disciplinary expertise (the vertical dimension of the T) alongside broad interdisciplinary competencies and values (the horizontal dimension). Conceptually, the holistic skill set of a student comprises four integrated dimensions: technical knowledge (Ktechnical), IPE proficiency (KIPE), collaboration competencies (Ccollaboration), and ethical values (Vethical).

The pedagogy for achieving this integration is informed by Constructivist Learning Theory, which posits that students construct knowledge by interacting and reflecting. By situating communications technology content within ideological and political discourse, learners are forced to critically examine the social effects of technology, leading to deeper understanding and wise use. The Collaborative Learning Model also prescribes that learning outcomes are improved via interaction and collaboration between students, lecturers, and industry players.

II. CURRENT STATUS OF DOMESTIC AND INTERNATIONAL RESEARCH

Current global engineering education models focus on integration across disciplines. Portugal, for instance, involves civic education in engineering programs via the Ethical-Technical Training Model by applying measures such as ethical project assessment and stakeholder analysis. ABET accreditation criteria and Bloom's Taxonomy are used in the US to determine moral reasoning in technical courses [4]. Table 1 below provides comparative practices.

TABLE 1. Comparative International Integration Models

Country	Education Strategy	Model Used	Outcome Indicator
Portugal	Ethics in Engineering	Ethical-Technical Training	Demonstrable improvement in civic competency
USA	Civic-integrated STEM	ABET + Bloom's Taxonomy	Improved ethical decision-making skills
China	Curriculum Ideological and Political	Three-Wide Model	Enhanced student political engagement and responsibility

A. DOMESTIC RESEARCH ON COLLABORATIVE EDUCATION MECHANISMS IN COMMUNICATION SYSTEMS AND IDEOLOGICAL-POLITICAL EDUCATION

Current domestic literature identifies two key problems: the ongoing gap between specialized technical education industry standards-driven and ideological education, and the lack of a workable collaborative education framework to bridge the two areas. The two skins phenomenon—referring to the separation between professional education and ideological education—reflects this gap whereby professional courses rarely incorporate value education, resulting in fragmented talent cultivation. Researchers suggest creating an integrative, systemic model of education that allows for joint curriculum development, inter-disciplinary faculty, and organizational facilitation. It would balance stringent communication systems standards (such as protocol conformity and technical expertise) with ideological-political objectives, producing graduates that are technically sound and ideologically sound.

B. INTERNATIONAL RESEARCH ON INTEGRATING TECHNICAL AND IDEOLOGICAL EDUCATION

Globally, there are fewer studies that directly tackle the integration of ideological-political education and technical fields such as communication systems. Nevertheless, there are parallel efforts in engineering ethics, liberal education, and social responsibility education. Ethical issues and civic responsibility are incorporated into STEM education in the US, with the goal of graduating well-rounded individuals with the ability for independent judgment and social consciousness. Likewise, Japan's educational reform programs prioritize the integration of specialization knowledge and civic virtues and problem-solving ability with flexibility. Despite these efforts, international models tend to make technical competence and moral-ethical training supplementary but distinct from each other, without a single collaborative mechanism of education that clearly links industry standards and ideological training. This gap suggests the potential for innovation in developing such a system in China, particularly in fields such as communication systems, in which technology and ideology are closely intertwined.

III. ESTABLISHING A COLLABORATIVE EDUCATION MECHANISM BETWEEN INDUSTRY STANDARDS IN COMMUNICATION SYSTEMS AND IPE IN PRIVATE UNIVERSITIES

A. THE NECESSITY OF COLLABORATIVE EDUCATION BETWEEN COMMUNICATION INDUSTRY STANDARDS AND IDEOLOGICAL-POLITICAL EDUCATION

Over the last few years, the rapid evolution of communication technologies such as 5G, IoT, and network security has reshaped the global information environment. For China's private universities, this type of technological innovation is a serious responsibility laced with the task of realigning education with the country's ideological and political goals [5]. Unlike well-resourced public institutions, private universities often face greater pressure to quickly adapt their curricula to market demands while simultaneously integrating complex national ideological mandates with limited governmental funding and faculty expertise, making the development of a structured collaborative mechanism an acute necessity for their survival and relevance. Being responsible for training future leaders of the communication system, such universities need to make sure that graduating students not only possess control of international and domestic technical standards such as those of the International Telecommunication Union (ITU), Institute of Electrical and Electronics Engineers (IEEE), and 3rd Generation Partnership Project (3GPP)—but also ideological consciousness based on socialist principles. This double requirement calls for the development of a cooperative education mechanism that integrates communication industry standards closely with IPE, thus bridging the technical and moral dimensions of professional education. The conventional method, in which professional technical training and ideological-political training are distinct, has been found wanting in addressing modern challenges. The result is usually a gap where technically proficient students lack the ideological underpinning to inform their professional and ethical decision-making [6]. For instance, technical expertise in communications transmission protocols combined with a deficiency in appreciation of the political implications of information security would result in professionals who are not adequately prepared to address the socio-political demands of the sector. Combining these two areas of study thus assists in graduating students capable of addressing both the technical intricacies of communications systems and their wider social implications [7].

B. CURRICULUM INTEGRATION: UNIFYING INDUSTRY STANDARDS AND IDEOLOGICAL CONTENT

Central to the collaborative education mechanism is curriculum integration, whereby IPE is woven into communication systems courses and vice versa. This requires careful restructuring of course content and pedagogy in order to facilitate the intertwining of technology and ideology.

Practically speaking, program courses such as wireless network, cybersecurity, and data communication are expanded from technical theories and standards. They are combined with political theories that can be mapped onto national security, governance, and ethical use of technology [8]. To illustrate, in learning 5G New Radio (5G NR) protocol implementation, teachers introduce the topic of how the technology improves China's digital sovereignty and national development strategy into the classroom. Cybersecurity courses, for their part, involve case studies comparing the national cybersecurity compliance mandates with the ideological underpinnings of data protection policies.

Conversely, IPE curriculum combines technical knowledge to make it more practical. Topics such as Marxist theory or socialist fundamental values are brought closer to reality through examples drawn from social governance and public opinion management outcomes of communication technology. In this kind of twoway curriculum design, students see ideological education as being tightly related to their future professional practice, and not as an abstract or detached discipline [9].

Table 2 below illustrates the manner in which technical and ideological aspects are integrated into the course content, practical work, and exams.

TABLE 2. Curriculum Integration Framework

Curriculum Aspect	Technical Content (Communication Systems)	Ideological and Political Content	Integration Strategy
Core Courses	3GPP 5G NR standards, ITU-T X.805 Security Framework, IoT protocols (e.g., MQTT)	Marxist theory, socialist core values, China's Cybersecurity Law, Digital Sovereignty	Case studies on ethical communication, security aligned with ideology
Practical Training	Simulation labs, internships implementing 5G NR radio access network (RAN) configuration	Workshops on political responsibilities, ethics in technology (e.g., responsible AI/surveillance use in communication networks)	Joint projects requiring technical solutions mindful of ideological values
Assessment	Technical exams, project evaluations (e.g., verifying IEEE 802.11 protocol compliance)	Reflective essays, participation in political discussions	Rubrics measuring both technical accuracy and ideological understanding

This type of curriculum integration is typically supported by project-based learning where students are assigned work that encourages them to use standards of communication as they reflect on ideological and ethical considerations. This approach improves technical expertise and fosters critical thinking about the social aspects of communications technology.

To assess the effectiveness of curriculum integration, this study proposes a five-level Curriculum Integration Maturity Framework based on established phased implementation models in educational development. The framework is presented in Figure 1. The five maturity levels are defined as follows:

Level 1: Ad hoc integration (stand-alone examples)
Level 2: Syllabus entries with explicit IPE references
Level 3: Team-taught modules
Level 4: System-wide coordination at the curriculum level

Level 5: Continuous feedback loops among industry, faculty, and students

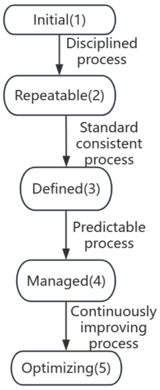

FIGURE 1. Curriculum Integration Maturity Framework

C. INTERDISCIPLINARY TEACHING TEAMS AS A FOUNDATION FOR COLLABORATIVE EDUCATION

The success of curriculum integration depends on cooperative work through collaboration by cross-disciplinary teaching teams of communication engineering and ideological-political educational specialists. The teams coordinate curricula, develop lessons, and give combined lectures integrating technical and ideological stories [10].

For example, in teaching network security protocols, the technical instructor gives lectures regarding the technical content and implementation problems based on IEEE or ITU specifications. The ideological instructor gives lectures about the national security policy implications, data privacy ethics, and socialist principles of China's cybersecurity law. Co-teaching enhances learning in the classroom so students know how and why they are learning.

Furthermore, the universities also utilize interdisciplinary teams with the responsibility of creating composite tests that examine students in both technical competence and ideological awareness. The tests may integrate technical problem-solving exercises and reflective essays examining communications technology application political and ethical meanings. Through comprehensive assessment, universities emphasize balanced competency development.

To enable such collaboration, institutions make investments in regular coordination meetings and interdisciplinary curriculum development workshops for building greater cross-disciplinary mutual pedagogical sensitivities and knowledge. Such cultural change towards interdisciplinarity is a very important step in institutionalizing the collaborative education mechanism [11].

D. FACULTY DEVELOPMENT: ENHANCING CROSS-DISCIPLINARY PEDAGOGICAL COMPETENCIES

Implementing a collaborative education mechanism demands lecturers who are adept at bridging communication industry standards and ideological-political education. Private universities have thus prioritized overall faculty development programs that focus on teachers' interdisciplinary knowledge and teaching abilities.

These programs include workshops that acquaint and renew engineering faculty with evolving industry pedagogy and policy for political education, and introduce ideological educators with basic communications technologies and proper industry standards. This cross-training allows the faculty to more easily understand counterparts' jargon and perspectives, and to collaborate more effectively on curriculum delivery and development. Crucially, successful completion of these cross-training modules is tied to a formal certification that is requisite for teaching integrated courses, serving as a powerful institutional safeguard against resistance.

Also, the universities encourage the participation of the faculty in teaching innovation competitions and research into cross-disciplinary integration [12]. Through these channels, teachers test new teaching paradigms such as flipped classrooms, case studies, and scenario simulations that incorporate technical standards as well as ideological reflection.

Instructional development also addresses assessment innovation, in which teachers are taught to create evaluation indicators that thoroughly examine students' technical competence and ideological expertise. One test, for instance, can examine the ability of a student to develop a network system that is ITU compliant and critically evaluate how well the system aligns with national cybersecurity policy. Furthermore, faculty performance reviews and promotion/tenure decisions will formally incorporate metrics derived from the Integrated Education KPI Tracker and student feedback on IPE integration, thereby mandating buy-in from technical faculty.

In private universities, institutional capacity for long-term interdisciplinary instruction is built by investing in faculty development, and it is imperative for the long-term success of the collaborative education mechanism.

E. STUDENT MENTORSHIP: SUPPORTING HOLISTIC DEVELOPMENT

For complementing curriculum and faculty changes, student mentorship at private universities is a key component of increasing the integration of communication industry standards and ideological education at an individual level. Private universities have developed mentorship models in which students are mentored by more than one mentor who are technically and ideologically experienced.

Students usually benefit from mentorship by working professionals who help ensure the technical skills of the students are in conformity with modern communication standards through project guidance and internships. In the meantime, ideological mentors help students obtain political theory knowledge, ethical technology use, and social responsibilities in their line of practice [13].

To gather empirical feedback on the effectiveness of the collaborative mentorship system, a postintervention survey was administered to a sample of 150 undergraduate students enrolled in their third year (Year 3) of the Communication Systems program, following the completion of a two-semester mentorship cycle. The investigation used a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) to assess student perceptions across key instructional and developmental indicators, specifically focusing on the clarity of the mentorship purpose, the ability to reflect on areas for improvement, the relevance of session content, and the encouragement to think beyond comfort zones. The percentages presented in Figure 2, which track these specific pedagogical metrics, were calculated by aggregating the responses of Agree (score 4) and Strongly Agree (score 5) for each statement, representing the proportion of students who affirmed the positive impact of the mentoring intervention. This allows mentorship programs to be quantitatively evaluated, supporting evidence-based reform.

The perceived impact of the collaborative mentorship system on student development is summarized in Figure 2.

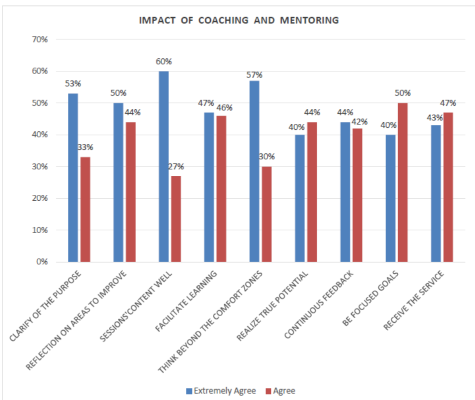

FIGURE 2. Student Survey Results on the Impact of Collaborative Mentorship

Career mentors help students integrate these cross-disciplinary skills to thrive in the work environment with ethical behavior and ideological consistency being highlighted as the most essential professional attributes. Enterprise mentors from sponsor industry partners also offer practical insights into how ideological policies influence business operations and innovation in communication networks.

Table 3 shows the division of mentorship responsibilities under this collaborative system.

TABLE 3. Collaborative Mentorship System

Mentor Type	Role	Responsibilities
Industry Mentor	Ensures students meet technical communication standards	Guides technical skills, oversees internships
Ideological Mentor	Cultivates ideological awareness and ethical responsibility	Conducts ideological education, supports political engagement
Career Mentor	Bridges interdisciplinary skills for career readiness	Assists with job preparation, ethical workplace behavior
Enterprise Mentor	Provides real-world industry context on technical and ideological integration	Supervises practical training, communicates enterprise culture

This form of mentoring has the potential to transfer holistic competencies to the students and make them not just technologically competent but also ideologically conscious communication technology practitioners.

F. INSTITUTIONAL AND INDUSTRY COLLABORATION: SHAPING EDUCATION TO NATIONAL GOALS

Developing a cooperative education system also means improving the interface of universities with communications industry stakeholders. This collaboration helps keep curricula aligned with evolving technical specifications and ideological guidelines and introduce students to practical learning experiences. The industry functions in partnership through the facilitation of internships for conformance with communication norms and ideological control, networking with curriculum advisory boards, and setting training programs in partnership with emphasis on secure and socially responsible communication technologies. This ongoing interaction helps align university programs with national strategic goals and industry needs.

Meanwhile, policy advice from ideological education departments promotes a mutually reinforcing synergy between technical innovation and ideological alignment, directly elevating the quality and practical relevance of graduate education.

G. CHALLENGES AND FUTURE DIRECTIONS

Despite model creation, private universities encounter a series of challenges in the full operationalization of the collaborative education mechanism. Institutional silos persist, at times making inter-disciplinary conversation between technical and ideological schools be hindered. Faculty workload and knowledge deficits limit the smooth co-design of blended coursework. In addition, creating effective assessment systems that validly measure combined technical and ideological learning outcomes remains a challenge. Subsequent efforts should also encourage cooperation between industry and ideological power to continuously revise curricula and provide whole, contextualized learning contexts. This way, through continued efforts, private universities can raise communication technology professionals who are not only technically proficient but also ideologically robust enough to contribute to the creation of a better China digital future.

IV. CHALLENGES IN INTEGRATING INDUSTRY STANDARDS AND IPE INTO COMMUNICATION SYSTEMS PROGRAMS

Despite increasing efforts to integrate IPE into university programs, private universities still face challenges in balancing such integration with the professional training of students in communication systems. The establishment of a cooperative education mechanism between ideological objectives and industry standards in communication technologies such as those of IEEE, 3GPP, and ITU—is still in fragmented and early stages.

This section discusses three dimensions of structural difficulties: fragmented integration between curricula, lack of adequate ideological content for technical fields, and no cooperative innovation mechanisms between industry and academe.

A. POOR INTEGRATION OF IDEOLOGICAL EDUCATION WITH STANDARDS OF THE COMMUNICATION INDUSTRY

One major challenge is the disparity between professional standards and ideological learning goals defining education in communication systems. Most of the private universities' communication programs are made up of courses such as Wireless Communication, Network Security, Signal Processing, and IoT Systems. These courses focus almost exclusively on technical skills but barely address the ideological and ethical dimensions of communication technologies such as data privacy, digital sovereignty, cybersecurity, or the communication role of AI.

In addition, instructors set their own goals for courses without having a shared ideological program that aligns with industry development. The outcome is disjointed instruction, with civic education in one course emphasizing patriotism or mutual responsibility, but another course not even touching on ideological values. Such uncoordinated attempts discourage the production of a coherent learning experience that aligns moral development with professional and technological growth.

In addition, IPE and professional course instructional faculty work in departmental silos. Scientists and engineers teach communication courses, and humanities or political science faculty teach IPE. Because of this departmental segregation, there is no coordination of curriculum design, and it is difficult to coordinate ideological content with technical needs. This absence of coordination implies that it is impossible to incorporate IPE into ethical use of monitoring systems, responsible innovation for 5G, or information integrity in network communication issues that are central to both ideological education and industry best practice.

B. DEFICIENCIES IN IDEOLOGICAL CONTENT OF COMMUNICATION SYSTEMS CURRICULA

The second key issue is the absence, and generally misplaced, incorporation of political and ideological content in communication systems courses. Most engineering instructors have had no formal training in civic education and therefore there is little or superficial incorporation of ideological topics. Where the content is incorporated, it has no relevance to the technical discipline, and therefore does not meaningfully engage the students.

For example, rather than address ethical concerns in network planning or information sharing in smart grids, some instructors speak only of abstract political catchphrases or ideological readings of history. Although such subjects are of cultural importance, they may appear disconnected from the technical realities that communication systems students must engage with in their professional training. This disconnect reduces student engagement, as it weakens the intended impact of ideological and moral development.

C. SHORTAGE OF COOPERATIVE MECHANISMS AMONG ACADEMIA, INDUSTRY, AND IDEOLOGICAL EDUCATION

The greatest challenge, perhaps, is the absence of systemic coordination across schools, ideological pedagogues, and actors in the communication industry. There are hardly any channels for co-design of curriculum content that incorporates technical standards and civic values. Training thus remains one-way towards technical skills or ideological principles rather than promoting a synergistic learning process. There are no institutional structures for training and motivating faculty to develop interdisciplinary courses exploring both professional and ideological skills. Newly hired faculty members in the majority of private colleges are evaluated in teaching and research productivity with little concern for whether they can teach ideologically oriented material. In-service infusion training in ideological content like ethical innovation, tech-for-good values, or national security consciousness into communication engineering is also non-existent or uncommon.

V. DEVELOPING AN INNOVATIVE SYSTEM OF COMBINED INDUSTRY STANDARDS AND IPE IN COMMUNICATIONS SYSTEMS

To equip communication systems students with technical skills and civic duty sufficiently, universities must establish a highly integrated innovation system. This integrated system would not only integrate IPE into professional training but also align the learning goals with industry standards, e.g., those of IEEE, 3GPP, and ITU. In private universities, in particular, this integrated system must be designed to be resource-efficient and highly dependent on active industry collaboration to overcome the typical challenges of limited research funding and faculty training resources, thus brid ging the gap between disciplinary teaching, industry req- uirements,and national ideological goals. Below is a four-component model of establishing such an innovative system : curriculum synergy, faculty development, institutional man agement, and resource support.

A. BUILDING A THREE-WIDE EDUCATION COOPERATIVE SYSTEM IN COMMUNICATION ENGINEERING

A pillar of this innovation is constructing a model of Three-Wide Education the entire curriculum, the entire educational process, and all the student stakeholders. In education for communication systems, this entails incorporating ideological learning into all aspects of course design and delivery.

1) Three-Dimensional Objectives: Knowledge, Ability, and Moral Quality

In order to balance technical material and civic values, communication systems courses need to define three-dimensional goals. These include:

- Knowledge transfer: communication protocol know-how, spectrum assignment, 5G infrastructure, etc.
- Development of skills: problem-solving, project design, and ethical innovation skills.
- Moral literacy: understanding national cyber sovereignty, ethical use of AI, and communication ethics.

Each course outline needs to reference how ideological and political objectives and technical instruction will be integrated. For instance, a course in Network Security could include modules on data ethics and national digital security policies.

2) Cross-Level Collaboration: Disciplines, Majors, and Courses

There should be cross-disciplinary synergy within disciplines, majors, and courses. Communication systems courses usually span across signal processing, IoT development, and cloud communications. Coordination is required so that ideological goals (responsible tech development or national interests) are adequately reflected across the curriculum. It must start from the talent development plan, then continue with communication standards and ideological learning objectives down the board.

3) Introducing IPE into Three Classrooms: Physical, Practical, and Virtual

IPE in communication systems education should not be confined to didactic classroom instruction. Instead, it needs to be embedded across three interconnected learning contexts:

- Formal classroom instruction: course materials that relate industry standards to social values (e.g., 5G privacy).
- Practical training (“second classroom”): laboratories and capstone projects in which students address real communication system problems under explicit ethical constraints.
- Online learning platforms (“third classroom”): discussion forums, interactive boards, and case-based simulations that facilitate the analysis of industry-related issues (e.g., the Huawei export restrictions and net neutrality).

B. CULTIVATING FACULTY CAPACITY FOR INTEGRATED IDEOLOGICAL-TECHNICAL EDUCATION

An innovation system will need to prioritize the building of faculty capacity in teaching interdisciplinarity. Engineering faculty will need to receive systematic education in IPE principles that apply to communication systems—media ethics, information warfare, and digital nationalism.

New college faculty need to be selected not only for technical competence but also for their understanding of moral and ideological imperatives of technological advancement. Modules of in-service training supported by industry case studies and state policy manuals can facilitate the faculty in imparting ideological content in teaching. Processes of political evaluation like classroom observation and student response to ideological integration must be institutionalized.

C. STRENGTHENING INSTITUTIONAL PROCESSES FOR CURRICULUM IMPLEMENTATION

In order to guarantee consistency and quality of ideological-political integration, institutions must introduce effective systems of teaching management. The Baseline (2023) values were established through a comprehensive institutional initial audit (including curriculum audit, end-of-term student surveys, and preliminary employer evaluations) conducted in the 2023 academic year, reflecting the pre-implementation status. The Target (2026) values were determined via institutional strategic planning, benchmarking against high-performing international integration models, and feasibility consultation with the interdisciplinary curriculum committee, setting ambitious yet achievable goals for the first three years of implementation. The Integrated Education KPI Tracker is shown in Table 4.

TABLE 4. Integrated Education KPI Tracker

Indicator	Baseline (2023)	Target (2026)	Tool
Percentage of courses with co-teaching	15%	60%	Curriculum audit
Student IPE understanding score	2.9/5	4.2/5	End-of-term survey
Industry feedback on student readiness	55%	85%	Employer evaluation forms

A key institutional safeguard for addressing the two skins phenomenon is the implementation of a rigorous, mandatory curriculum audit conducted by an interdisciplinary committee that includes IPE specialists. This committee is empowered to reject or require revision of any communication systems course syllabus that does not explicitly allocate a measurable portion of class time, required readings, and assessment weight to the IPE and national goals, ensuring structural compliance before the course is offered.

D. SUBJECTIVE INITIATIVE IN TEACHING

Its faculty must be motivated to become owners of ideological education, incorporating it proactively into wireless engineering, satellite communications, and coding standards courses. Workshops for faculty can get instructors to link political theory with technical instruction through the use of examples such as China’s policy on digital infrastructure or regulating AI.

E. FORMULATING TEACHING AIMS WHICH PRIORITIZE MORAL EDUCATION

Professional ambitions must move beyond technical needs to serve civic and national agendas. For example, a 5G infrastructure education course must include the social implications of digital divides and geopolitical competition for telecom supremacy.

F. DEVELOPING SYLLABI THAT REFLECT IDEOLOGICAL AND TECHNICAL INTEGRATION

Every syllabus should not just outline learning outcomes but also ideological outcomes. It should answer the questions: What are the values that will be transmitted by this course regarding ethical use of communication technologies? How will the students learn about the role of engineers in society to protect digital sovereignty? The final syllabus must include a mandatory IPE Integration Statement that outlines the time allocation and assessment weighting for ideological content and that is subject to approval by the cross-disciplinary review committee.

G. ESTABLISHING SUPPORT MECHANISMS FOR SUSTAINABLE COLLABORATIVE INNOVATION

H. RESOURCE SECURITY MECHANISM

Effective implementation requires the provision of adequate financial, material, and human resources. Investment should be directed toward the following areas:

- Technical infrastructure: laboratory equipment to support value-based projects (e.g., secure network design).
- Digital platforms: online discussion forums for communication ethics.
- Faculty incentives: bonuses and rewards for the successful integration of ideological elements into technical training.

In addition, industry stakeholders—including telecom operators, network security firms, and government agencies—should be invited to co-invest in this initiative through funded projects or teaching partnerships.

I. INSTITUTIONAL SAFEGUARDS

The most senior policy papers should mandate ideological incorporation into STEM courses. Departmental policy should provide operational guidance, from curriculum overhaul to cross-disciplinary team-teaching. Regular audits and outcome measures will ensure continuous improvement and compliance with educational and ideological standards.

VI. CONCLUSION

This paper rigorously addresses the critical need to establish an integrated and collaborative education mechanism that effectively bridges communication systems industry standards (ITU, IEEE, 3GPP) with IPE, particularly within the context of China's private universities. Recognizing that modern technology demands professionals who are both technically proficient and ideologically conscious, this study proposes a systemic solution to overcome the prevalent two skins phenomenon, in which technical and value-based education remain siloed.

The model is structured as a four-component innovation system encompassing curriculum synergy, faculty development, institutional management, and resource support. Central to this system is the construction of a Three-Wide Education framework that embeds ideological learning across the entire curriculum, the full educational process, and all student stakeholders. This framework is operationalized through the definition of three-dimensional objectives (knowledge, ability, and moral quality), the establishment of cross-level collaboration among disciplines, and the integrating of IPE into formal, practical, and virtual learning environments.

The proposed framework ensures that core technical courses—like network security and 5G architecture— are actively fused with national cybersecurity policy, digital sovereignty, and socialist principles. This integration, supported by cultivating interdisciplinary teaching teams and implementing faculty development programs that train engineers in IPE and ideological educators in basic communication technology, aims to produce holistic graduates. Similarly, professionals entering industry must be prepared to navigate the ethical, social, and political implications of technology, aligning their academic training with national strategic and moral goals, particularly concerning the ethical use of automation, transparent supply chain communication, and compliance with labor and environmental regulations.

AUTHOR CONTRIBUTIONS

Zongjian Fan designed, collected and analyzed the data, and drafted the manuscript. Zongjian Fan conducted the study, critically revised the manuscript for important intellectual content, and gave final approval of the version to be published. Zongjian Fan participated fully in the work, take public responsibility for appropriate portions of the content, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICTS OF INTEREST

The author declares no conflict of interest.

FUNDING

This research received no external funding.

ACKNOWLEDGEMENTS

Not applicable.

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