Advances in Vocational and Technical Education (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/avte.2025.070206
ISSN 2523-5834 Vol. 7 Num. 2

Integrating IoT Curriculum with Ideological-Political Education: A Four-Dimensional Evaluation System

Jie He[1,a], Hong Ran[1,b,*]

[1]School of Electronics and IoT Engineering, Chongqing Industry Polytechnic College, No.1000 Taoyuan Road, Yubei District, Chongqing, 401120, China
[a]hejie@cqipc.edu.cn, [b]ranhong@cqipc.edu.cn
**Corresponding author*

Keywords: IoT Education; Curriculum Ideological and Political Education (CIPE); Four-Dimensional Synergy; School Credit Bank

Abstract: This study addresses the critical gap in IoT education by proposing a holistic evaluation framework that synergizes technical skill development with ideological-political cultivation. Traditional IoT curricula often prioritize technical competencies while neglecting holistic student growth, leading to mismatches between educational outcomes and industry demands. To bridge this divide, we introduce a four-dimensional synergy mode ("knowledge enhancement, capability cultivation, affective identification, value shaping") integrated with a school credit bank system. This innovative framework quantifies learning achievements across four interconnected dimensions — learning background, content input, learning process, and outcomes — converting them into transferable credits aligned with industry standards. Pilot implementations in IoT courses at Chongqing Industry Polytechnic College demonstrated significant improvements: Students achieved technical proficiency benchmarks, exhibited exemplary ethical decision-making, and secured employment within six months post-graduation. The system's dynamic tracking capabilities and modular credit design ensured alignment with national strategies (e.g., China's Three-Year Action Plan for IoT Infrastructure) and employer expectations. By fostering multistakeholder collaboration and leveraging lifelong learning pathways, this model offers a replicable solution for vocational education reform, balancing technological innovation with socialist core values.

1. Introduction

Higher education institutions serve as primary arenas for national talent cultivation, playing a pivotal role in fostering holistic development through curriculum design and pedagogical innovation. In recent years, driven by the deepening integration of ideological and political (IP) education into specialized curricula, universities have actively explored synergies between IP education and discipline-specific teaching. This strategic alignment aims to amplify the impact of moral education, cultivating students' correct worldviews, life philosophies, and values while nurturing their sense of social responsibility and innovative capabilities.

The field of Internet of Things (IoT), characterized by its interdisciplinary nature encompassing

hardware design, software development, and network communications, demands a dual focus on technical expertise and ethical literacy[1]. While traditional IoT education prioritizes technical skill acquisition, it often overlooks the integration of IP education, resulting in gaps in students' ideological maturity and practical competency[2]. Conventional student evaluation systems exacerbate this imbalance by emphasizing rote memorization and exam performance over holistic growth, failing to capture advancements in ethical awareness, creativity, or vocational adaptability[3].

In response to the demands of lifelong learning, the School Credit Bank system has emerged as a transformative educational framework. By quantifying learners' knowledge and skills into transferable credits stored within a centralized "bank," this system bridges fragmented learning pathways, creating a dynamic ecosystem for lifelong education. Such mechanisms empower students to tailor their educational journeys to personal and professional goals, accumulating credits through diversified learning modalities (e.g., formal courses, internships, certifications) and converting them into recognized qualifications. This flexibility not only incentivizes continuous skill enhancement but also aligns academic progress with evolving industry demands.

Drawing on the four-dimensional synergy framework ("knowledge enhancement, capability cultivation, affective identification, and value shaping"), this study proposes a novel evaluation system integrating IP education into IoT curricula[4][5]. By anchoring assessment outcomes to credit accumulation and conversion, the system fosters a cohesive learning environment that rewards both technical proficiency and ethical development.[6] Leveraging the school credit bank's dynamic tracking capabilities, students can amass credits incrementally across academic and extracurricular domains, enabling seamless transitions between formal education and professional growth.

This research endeavors to construct and validate a multi-stakeholder collaborative evaluation model for IoT education, grounded in the principles of credit bank mechanisms and IP integration. By examining its efficacy in enhancing educational flexibility, bridging theory-practice gaps, and promoting equitable access to quality learning, the study aims to offer actionable insights for vocational and technical education reform in the era of Industry 4.0.

2. Connotation and Implementation Strategies of CIPE in IoT Specialized Courses Connotation

In IoT professional courses, educators must accomplish dual objectives: systematically imparting technical knowledge (e.g., IoT architectures, communication protocols, data processing) while integrating ideological and political education (IPE) to cultivate students' socialist core values, strengthen national identity, and foster holistic personality development. This dual focus ensures students not only master IoT competencies but also internalize ethical reasoning, social responsibility, and a sense of mission aligned with national development goals. By aligning curriculum design with China's national strategies—such as the Three-Year Action Plan for the Construction of New IoT Infrastructure (2021–2023)—educators can contextualize IoT advancements within national priorities, emphasizing IoT's pivotal role in digital infrastructure development. Highlighting achievements like the BeiDou Navigation Satellite System and Huawei's HarmonyOS ecosystem, instructors can inspire student pride in technological sovereignty and clarify the significance of IoT talent cultivation, thereby reinforcing the superiority of socialist institutional advantages.

Effective implementation of IoT IPE requires innovative pedagogical approaches and robust evaluation mechanisms. Teachers should embed ideological elements into technical content by analyzing real-world applications (e.g., IoT in smart cities, precision agriculture) and industrial

achievements (e.g., NB-IoT deployments), enabling students to recognize IoT's societal impact while reinforcing socialist values. Project-driven learning—such as designing IoT systems for environmental monitoring—should integrate technical skills (sensor networks, edge computing) with ethical considerations (data privacy, sustainability), fostering professionalism and critical thinking. For evaluation, a diversified framework should assess knowledge mastery (exams on IoT protocols), skill application (project execution), and value formation (ethical reflection essays). Combining peer reviews, self-assessment logs, and industry mentor feedback ensures comprehensive evaluations that balance academic rigor with ideological cultivation. This dual emphasis on innovation and assessment guarantees that IoT education equips students with both technical expertise and the ethical grounding necessary to contribute to national digital transformation.

3. Construction of Evaluation Systems for IoT Professional Students

Evaluation systems for IoT students must holistically assess technical competencies (e.g., hardware design, software development, network communication) while maintaining flexibility to adapt to emerging industry trends and requirements. A robust system should integrate multiple dimensions, including curriculum quality, practical skills, professional ethics, and innovation capacity. To ensure practicality, evaluation criteria and methodologies must be explicitly defined[7], balancing standardized metrics (e.g., exams, assignments) with practical assessments (e.g., project execution, team collaboration). Transparency in the evaluation process is critical to guarantee fairness and credibility.

Aligned with the "job-competition-certification integration" philosophy, the evaluation framework should reconstruct curricular content to align with occupational standards. For instance, course design must emphasize IoT applications in smart cities or industrial automation to mirror real-world industry demands. Assessment indicators should prioritize applied competencies—such as system planning, protocol configuration, and troubleshooting in smart IoT environments—over rote memorization. This approach ensures students develop job-ready skills while fostering adaptability to evolving technological landscapes[8].

4. Application of the "School Credit Bank" in Student Evaluation Systems

The "school credit bank" system provides innovative perspectives and methodologies for constructing evaluation frameworks in IoT education. By promoting multidimensional evaluation metrics, intelligent assessment processes, and internationally recognized outcomes, the school credit bank enhances students' comprehensive competencies and adaptability to industry demands.

4.1 Mechanisms and Core Principles of the School Credit Bank

As an emerging educational management model, the school credit bank's core philosophy lies in establishing a lifelong learning framework through credit accumulation and conversion mechanisms. It translates learners' achievements at different stages into standardized credits stored within a centralized system, supporting continuous education and career development. This flexible and innovative model introduces new possibilities for IoT student evaluation systems.

Advantages of integrating the school credit bank include:

1) Standardization and Modularization of Learning Outcomes

The school credit bank emphasizes comparability and standardization of learning outcomes. By modularizing IoT curricula—where each course, project, or practical training generates transferable credits—the system provides quantifiable metrics for evaluation. This modular approach is

particularly suited to IoT's rapid technological evolution and interdisciplinary nature.

2) Lifelong Learning Pathways

Through dynamic credit recording and conversion, the system enables continuous skill upgrading, aligning with IoT's demand for professionals to engage in lifelong learning and adapt to emerging technologies.

3) Resource Sharing and Cross-Domain Integration

The school credit bank integrates academic, industrial, and societal learning resources. By aligning with industry standards, students can complete part of their learning through internships or online platforms, ensuring evaluations reflect real-world competencies.

4.2 Specific Roles of the School Credit Bank in IoT Student Evaluation

The school credit bank transforms IoT evaluation systems from uni-dimensional to multidimensional frameworks. Traditional systems prioritize academic performance, whereas the school credit bank incorporates practical training, teamwork, and innovation. For example, credit records may document students' contributions to IoT projects, evaluating task completion, role effectiveness, and peer collaboration. This holistic approach better captures students' overall capabilities.

The school credit bank's flexible recording and conversion mechanisms allow students to tailor learning paths to personal interests and career goals. This adaptability not only motivates learners but also ensures evaluations remain aligned with industry trends. By integrating occupational requirements—such as ethics, teamwork, and innovation—the school credit bank translates these into evaluation metrics. For instance, IoT employers' emphasis on problem-solving and collaboration is embedded in credit criteria, ensuring graduates meet workforce demands. The system generates visual growth trajectories by converting coursework, projects, and internships into credits. These transparent records help students identify developmental gaps and guide instructors in refining teaching strategies.

4.3 Integration of the "School Credit Bank" with the "Four-Dimensional Synergy" Model for Holistic Student Evaluation

The "school credit bank" mechanism is synergistically integrated with the "four-dimensional synergy" model to establish a comprehensive evaluation framework for IoT students. This approach transcends traditional academic performance metrics by encompassing four interconnected dimensions: learning background, content input, learning process, and learning outcomes. The school credit bank dynamically records achievements across these dimensions, converting them into transferable credits that reflect students' evolving competencies. For instance, a student's contribution to an IoT cybersecurity project might earn credits for technical skill application (e.g., firewall configuration) and innovation (e.g., novel threat detection algorithms), while team-based assignments assess professional competence through peer evaluations of leadership and communication. By aligning credit accumulation with IoT industry demands—such as Huawei HCIP-IoT certification requirements—the system ensures evaluations remain anchored in real-world applications, fostering both academic rigor and practical readiness.

This holistic framework bridges the gap between education and industry needs, offering students a transparent credit roadmap to track progress and refine goals. For example, content input dimension evaluations—rooted in curriculum design aligned with cutting-edge IoT trends like edge computing—ensure pedagogical relevance, while learning process metrics (e.g., lab participation, collaborative problem-solving) cultivate essential soft skills. Simultaneously, the credit bank's dynamic conversion mechanisms allow students to tailor learning paths, such as pursuing

internships or online modules to address skill gaps. Instructors leverage credit data to adapt teaching strategies, prioritizing high-impact areas like IoT system design or ethical data governance. Ultimately, the system's continuity lies in its ability to transform fragmented learning moments into cohesive competency narratives, empowering students to navigate IoT's rapid technological evolution while maintaining alignment with socialist values and professional ethics.

5. Conclusion

This project explores the integration of a four-dimensional evaluation framework: "knowledge enhancement, competency development, emotional identification, and value shaping" into IoT curricula, linking assessment outcomes to credit accumulation and conversion. By designing flexible learning pathways, students can achieve lifelong learning goals through dynamic credit management. The evaluation system guides students to "cultivate moral character and aspirational talent" by establishing student growth portfolios that holistically monitor talent development processes, ensuring fair and recognized evaluations for every learner. This innovative school credit bank-based evaluation framework further deepens the value orientation of "cultivating virtue through education", enhancing teaching quality, elevating students' comprehensive competencies, and ensuring the sustainability and systemic integrity of the assessment system.

This approach not only optimizes resource allocation but also ensures the evaluation system evolves in alignment with technological advancements and industry demands.

Acknowledgements

This work is supported by Innovative research and practice on talent cultivation of IoT professionals based on the credit bank model project of the 2023 Vocational Education Teaching Reform Research Program of Chongqing Municipal Education Commission (No. Z232009), and Ideological and Political Education Program of Chongqing Industry Polytechnic College (2023GZYSZY-14).

References

[1] Li, X., Wei, Q. C., & Zhang, H. F. (2025). Exploration and practice of ideological and political education in higher vocational surveying courses under the "Three Educations" reform context. Hubei Open Vocational College Journal, 38(4), 74–77.

[2] Chen, Y. (2020). Inquiry into ideological and political education for college students in science and engineering in the new media era. Science and Technology Wind, (22), 160.

[3] Tan, X. G., Li, X. H., Zhao, Z. Q., et al. (2022). Exploration on ideological and political education construction of introduction to artificial intelligence courses under the background of new engineering disciplines. Journal of Higher Education, 8(18), 186–189.

[4] HUSNANDA A, IKHSAN J. Developing Science Education Game Based on Internet of Things (IoT): Materials and Methods Overview[J]. Journal of Educational Technology, 2025, 15(2):45-60.

[5] ZHONG X, QIAO R. Innovative Teaching Reform in IoT Control Technology and Applications[J]. IEEE Transactions on Education, 2024, 67(3):210-213.

[6] LI H, SUN Y, YANG M, et al. The establishment of academic credit accumulation and transfer system: A case study of Shanghai Academic Credit Transfer and Accumulation Bank for Lifelong Education[J]. International Journal of Lifelong Education, 2013, 32(2):201-212.

[7] GUO H. The Design of Teaching Evaluation and Organization System Based on the Internet of Things Using Fuzzy Comprehensive Evaluation Software[J]. Journal of Educational Technology Systems, 2021, 50(2): 189-212.

[8] HE D. Discussion on the Integration of "Post, Course, Competition, Certificate": Taking the Internet of Things Application Technology Courses in Higher Vocational Colleges as an Example[J]. Vocational and Technical Education, 2024, 45(9): 30-37.