Research on a "Software-Hardware Integration and Data-Intelligence Driven" Talent Cultivation Model for Electronic Information Majors in the AI Era

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Abstract: With the rapid advancement of AI driving the electronic information industry transition from digitalization to intelligentization, higher education has new challenges for talent cultivation. To address persistent challenges in Electronic Information majors such as curriculum obsolescence, inadequate software-hardware integration and inflexible evaluation, we propose Software-Hardware Integration and Data-Intelligence Driven cultivation model based on the "New Engineering" initiative incorporating four components: visualized curriculum knowledge graph, AI-assisted PBL, virtual-real integrated practice platform and multidimensional evaluation system. By breaking down silos and allowing deep convergence between AI and Electronic Information disciplines, we aim to cultivate innovators in hardware design and advanced intelligent algorithms as theoretical and practical reference for high quality talent development.
Keywords**:** artificial intelligence, electronic information majors; industry-education integration; talent cultivation model

1. Introduction

Artificial Intelligence (AI) has become a powerful force to promote the development of social and economic, especially in the electronic information industry. Communication technology is rapidly advancing towards 6G, with high speed enabling real-time interconnection between intelligent devices, increasing the integration of hardware. Large language models (LLMs) run rapidly on intelligent devices. Although AI has great potential for innovation, it poses greater challenges in cultivating and reserving outstanding talents in the future electronic information field. Currently, the training efforts in universities are mainly focused on tool application, without systematically studying the core characteristics of the electronic information field. This has led to a structural imbalance between theory and practice, hardware and intelligence.

To overcome these imbalances, we must strengthen the foundation of mathematics and circuits, and at the same time cultivate advanced intelligent application skills[1]. We propose a "software-hardware integration and data intelligence-driven" training model, which is in line with the "New Engineering" initiative and points out the direction for the development of the electronic information major.

2. Challenges in Electronic Information Talent Cultivation

As AI is becoming increasingly prevalent in different industries, Electronic Information majors act as a bridge between the physical and digital worlds. The quality of talent cultivation directly affects the core competitiveness of the national information industry. Progress has been made but still major challenges remain, such as curriculum timelines, diversity of teaching methods and integration of practical training.

2.1 Lagging Curriculum System

Current curriculums are mostly "Circuits—Signals—Systems" and focus on basic analog/digital circuit design and fundamental communication principles. Core professional courses struggle with content updates in recent years, which result in latency between knowledge systems developed by graduates and new industrial technologies[2]. Students majoring in electronic information need to deeply integrate with computer science and automation disciplines, but currently, interdisciplinary collaboration is one way to achieve better integration. Universities may offer AI courses or Python programming as elective courses, but these courses do not systematically incorporate deep content or link it to the core electronic information disciplines. This may lead to a fragmented knowledge situation, where students understand hardware but lack sufficient algorithmic knowledge and do not have a complete understanding of circuit logic.

2.2 Monolithic Teaching Approaches

The teaching abilities of educators and their adherence to traditional teaching practices have constrained theoretical instruction. Students can only passively accept the teacher-centered teaching method. In this model, teachers use summative tests (homework and final exams) to measure learning status, which leads to a delayed feedback loop. If students encounter bottlenecks when conducting complex circuit design or code debugging after class, lacking direct and effective guidance will affect their learning enthusiasm. Therefore, more attention should be paid to cultivating "top-level innovative talents".

2.3 Disconnected Practical Training

Engineering practice is one of the core competencies for professionals in the field of electronic information. The current practical training system is not suitable for talents in this field. Verification experiments occupy a large part of the curriculum, lacking innovative engineering projects that involve independent exploration and systematic design. Laboratory equipment is updated poorly, often relying on outdated training kits for simple functional verification. There are no development environments based on modern AI chips or deep learning frameworks, and students cannot design end-to-end systems spanning “Data Acquisition, Transmission, Algorithm Processing”. Students often “run algorithms on blackboards” and “wire manual wiring on breadboards”, which makes it difficult to adapt to enterprise requirements for AI Edge Computing and Intelligent Hardware Development.

2.4 Rigid Evaluation Mechanisms

Talent evaluation systems relies heavily on final written test scores. They neglect the application of theoretical knowledge and lack formative measures of practical ability, innovative thinking and teamwork. Since AI assistive tools are ubiquitous, traditional assessments are not only inadequate to reflect student general qualities but also fail to distinguish between independent work and AI content. Evaluation metrics fail to quantify implicit qualities such as interdisciplinary integration or engineering ethics. Without scientific data tracking, students' contributions to projects, code quality evolution and problem solving ability are not measured, resulting in “high academic scores but low functional competence”.

3. Model Reform in the AI Era

As AI technology grows exponentially and the electronic information industry is changing dramatically, traditional “cremental” teaching approaches are no longer sufficient to meet contemporary demands. We propose here a new “Quadripartite framework” for Talent Acquisition, based on the “T-shaped Talent” philosophy supported by Knowledge Graphs, AI Assistance, and Virtual Reality integration, and aims at deep, top-level convergence between professional education and AI technology[3].

3.1 Goal: T-Shaped Composite Talents

We define the cultivation goal as cultivating AI + Electronic Information composite innovators with strong ability in electronic system design with intelligent data processing and deployability skills. By breaking down disciplinary barriers and integrating knowledge from Computer Science, Automation and Data Science, we increase student academic potential to “AI+X” interdisciplinary mindset[4].While retaining existing strengths in Circuit Analysis and Signal Processing, we prioritize core competencies in Edge Computing, Embedded AI and Intelligent Sensing, solving practical engineering problems that AI algorithms work “high efficiency, low latency and stability” on hardware platforms.

3.2 Curriculum: AI-Driven Reconstruction

To solve fragmentation and obsolescence problems, we use AI to restructure the curriculum in a tier: Strong Foundation (Bottom), Integration (Middle) and Innovation (Top). Firstly, using Natural Language Processing (NLP), we use teaching resources to construct a Curriculum Knowledge Graph linking knowledge points scattered in Signals and Systems and Digital Image Processing courses (e.g., Convolution) to industrial standards. By exploring this graph students can see how industrial concepts can be used to build the “systematic Knowledge Construction”. Secondly, using AI models, we convert new industry cases into teaching content in real-time, creating dynamically updated “Digital Textbooks” to ensure course content synchronized with the “Hardware-Software Integration” trends.

3.3 Teaching: LLM-Enabled Blended Learning

LLMs are efficiency boosters and catalysts that change teaching workflows and teacher-student interactions. Customized digital teaching assistants (CTAs) provide round the clock personal support—Diagnosing logical errors and optimizing embedded development and algorithm code—for the frequent absence of immediate guidance when independent study. The system also supports adaptive learning by analysing query histories and assignment data to find knowledge gaps and suggest specific micro-lectures or supplementary exercises. User feedback generally indicates significant efficiency gains from AI models and high interest in personalized learning plans. We also implement AI-Assisted Project Based Learning (AI-PBL)

[5] for brainstorming, solution verification and literature reviews for big projects such as intelligent logistics vehicles or machine vision-based defect detection.

3.4 Practice: Virtual-Real Training Ecosystem

A model with virtual simulation and physical training to address fast hardware loss, high cost and limited training scenarios is proposed. The virtual simulation component uses AI and digital twin technologies to create high-fidelity virtual laboratories, for example in Electromagnetic Fields and Microwave Technology courses, the system simulates signal coverage for different antenna layouts, giving students the ability to visualize 5G millimeter-wave propagation, and perform low-cost optimizations. The physical training track also strengthens industry-education integration through joint laboratories with enterprises, using enterprise-grade platforms (Haiwei Atlas and FPGA kits) and real industrial datasets for hands-on algorithm deployment and hardware-in-the-loop co-debugging.

4. Quality Assurance and Evaluation

To address the problems faced by the electronic information major, a team with both theoretical and practical capabilities is needed to be formed. In the educational model of AI, teachers should constantly acquire skills in knowledge graph construction and human-computer interaction. By using AI to solve open-ended engineering problems, teaching methods should be dynamically adjusted based on analysis reports to promote human-computer collaboration. Engineers with rich research and development experience can serve as part-time mentors, integrating actual engineering cases and standards into graduation projects and course designs. Additionally, full-time teachers can undertake internships at enterprise R&D centers or be temporarily assigned to these institutions.

The traditional assessment methods mainly rely on summative written tests. These tests often fail to comprehensively reflect students' actual engineering skills and innovative thinking. To abandon the single-dimensional scoring method, we need to adopt a process-oriented value assessment system based on big data and behavioral analysis to measure performance. Firstly, the code and engineering capabilities are evaluated through an automated system, assessing the complexity of the logic and the debugging process, and emphasizing the quality of the development work. Secondly, in the virtual simulation environment, the experimental operation ability is measured by analyzing digital footprints such as operation trajectories, parameter configurations, and fault-finding logic, thereby achieving scoring based on intelligent processes. Finally, the collaboration ability is measured through contributions on the collaboration platform, communication patterns and interaction with AI teaching assistants.

5. Conclusion

The rapid evolution of AI presents challenges and opportunities for Electronic Information majors. Based on the New Engineering model, structural flaws in current talent cultivation are addressed, namely curriculum loss, lack of hardware-software synergy and rigid evaluation. A new AI + Electronic Information training model is proposed to tackle these issues, which include reconstructing curriculum using Knowledge graphs for removing silos, using LLMs for personalized adaptive learning, Virtual-Real platform for bridge the gap between industry and multidimensional assessment system for engineering competencies. With the Software-Hardware Integration and Data-Intelligence Driven model, new electronic engineers will be built to support national technological sovereignty and industrial modernization.

Acknowledgments

This work was supported by the Scientific Research Project of Higher Education Institutions in Anhui Province (Grant No. 2024AH051117 and 2025AHGXZK30471), the Natural Science Horizontal Research Project of Anqing Normal University (Grant No.H20250111), the Anqing Normal University School-level Teaching Research Project (Grant No. 2024aqnujyxm62), the Provincial Quality Engineering Project of Higher Education Institutions in Anhui Province (Grant No. 2023jcjs082), the Anhui Provincial Key Laboratory of Advanced Catalysis and Energy Materials (Grant No. ZD2022013) and the New Era Education Quality Project Postgraduate Education of Anhui Province (Grant No. 2023xscx112).

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