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Limitations and reform pathways for university financial accounting education in the digital intelligence era

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Abstract
Technological innovations in the digital intelligence era are fundamentally transforming professional competencies required in the accounting industry, exposing traditional university financial accounting education to critical challenges. These include misaligned curricula lagging behind digital intelligence innovations, pedagogical frameworks devoid of contextualized practice, and inadequate development of "Dual-qualified" teachers. Such deficiencies cause a mismatch between academic outputs and industry demands for professionals equipped with integrated techno-business-analytical competencies. This study systematically examines existing constraints and proposes an industry-education integration reform framework comprising: (1) redesigning technology-embedded curricula to align with digital intelligence ecosystems; (2) implementing scenario-driven pedagogical models for contextual skill development; (3) fostering university-industry partnerships to operationalize resource synergies; (4) cultivating "Dual-qualified" teachers through interdisciplinary capacity-building initiatives; and (5) adopting a three-dimensional evaluation model ("process-comprehensive-application") to assess educational efficacy and learner competencies. The research offers empirically grounded strategies to advance the digital intelligence transformation of financial accounting education, ensuring the sustainable development of industry-ready talent pools.

Keywords: “Dual-qualified” teachers, industry-education integration, financial accounting education, digital intelligence, three-dimensional evaluation model

1. Introduction
The rapid evolution of information technology and intensified intelligent trends position the digital intelligence (DI) era as a transformative phase in technological civilization (Zhang, 2024) [30]. This era witnesses accelerated advancements in data science and information technologies, including extensive applications of big data, artificial intelligence, and blockchain. Innovations such as digital payment systems and IoT-powered smart homes enhance daily convenience, while digitized public services and intelligent transportation systems optimize societal efficiency. Modern flexible manufacturing systems and data-driven supply chains accelerate the restructuring of global industries. Concurrently, emerging occupations—data annotators and AI trainers—exemplify professions centered on data-algorithm symbiosis. Collectively, these developments underscore how the DI era reconfigures daily life, social operations (Zhang & Lu, 2021) [29], and the foundational logic of global industrial and occupational ecosystems (Feijao *et al*., 2021; Chen & Tang, 2022) [7, 6]. Higher education institutions confront multidimensional disruptions from DI while navigating structural transformations. Pedagogically, ubiquitous information access challenges conventional teaching paradigms (Nieminen *et al*., 2025) [17], compelling systemic responses to digital transition imperatives. Artificial intelligence emerges as a pivotal solution, enabling personalized learning trajectories and intelligent education management systems to address fragmented pedagogical resources and unidirectional knowledge delivery, thereby catalyzing intelligent, modular, and learner-centered educational models. In talent cultivation, escalating demands for innovative, applied, and interdisciplinary professionals (Bravo *et al*., 2021) [2] necessitate academia-industry alignment through curriculum dynamism and labor market responsiveness. Implementing industry-education integration and interdisciplinary synergies allows universities to redesign cultivation frameworks,

embedding DI literacies into curricula. Achieving these goals requires collaborative efforts among educators, policymakers, and industry experts to leverage big data and AI technologies in constructing equitable learning ecosystems that prioritize DI era competencies. Through such coordinated actions, higher education can architect digitally-adaptive pedagogical systems, establishing leadership in the DI paradigm.

Financial accounting education (FAE) constitutes a pivotal challenge in higher education, particularly within business disciplines, as it confronts transformative pressures in the DI era. The discipline faces dual challenges: First, persistent stagnation in pedagogical innovation over eight decades has resulted in an overreliance on technocentric curricula (Ballantine *et al*., 2024) [1], exposing accounting education to existential challenges amid AI advancements. Second, the evolving corporate landscape demands financial professionals transition from retrospective reporting to predictive analytics, triggering a 320% surge in demand for big data-driven financial analysis competencies (Goncalves *et al*., 2022). This paradigm shift has created structural mismatches between talent supply and industry needs. Compelling evidence underscores the urgency for curriculum reforms (Cai, 2022) [4], as delayed updates risk graduates' professional adaptability and career progression. Contemporary FAE must prioritize developing students' DI competencies through three key strategies: cultivating "Dual-qualified" teachers proficient in emerging technologies, implementing industry-education integration mechanisms, and establishing a three-dimensional evaluation model. These initiatives collectively establish essential competencies for future-ready professionals while driving sustainable industry development.

2. DI Era Accounting Competency Demands

2.1 Technological Tools Synergy

The utilization of tools in the DI era has evolved from singular applications to integrated combinations of multiple technologies. This integration transcends superficial aggregation of tools, emphasizing workflow-driven collaboration and systemic interoperability (Qu *et al*., 2019) [21]. Professionals must achieve proficiency in cloud financial platforms like Kingdee Cloud Suite and Yonyou NC, which serve as data hubs bridging operational and financial systems. Robotic Process Automation (RPA) interfaces should be deployed to automate repetitive tasks through platform APIs, thereby minimizing redundant labor costs. Post mass data accumulation, Hadoop-based technologies enable data cleansing, integration, and structural organization to facilitate advanced analytics. Tools such as Power Business Intelligence (BI) generate dynamic visual reports, while artificial intelligence applications enhance predictive financial modeling and risk decision-making. Blockchain integration further improves transactional transparency and traceability. Such interconnected toolchains demonstrate workflow-centric coordination. Given rapid technological iteration, FAE must transcend isolated software training. Curricula should prioritize cultivating students' adaptive competencies in orchestrating tool ecosystems, emphasizing sustainable learning strategies to master emerging technologies. This pedagogical shift builds core competitiveness for accounting professionals in DI era by fostering proactive tool adaptability and interdisciplinary coordination capabilities.

2.2 Position-Driven Competency Restructuring

Technological transformation in the DI era is driving fundamental changes in financial accounting positions (Londoño-Cardozo, 2025) [13], necessitating adjustments in university talent cultivation strategies. Highly repetitive tasks, including bookkeeping, account reconciliation, and report preparation, are being replaced by RPA and AI automation. Consequently, the responsibilities of entry-level positions are shifting towards managerial functions such as operational support, system maintenance, and data inspection. This shift requires universities to de-emphasize training focused on procedural operational skills and instead enhance the development of capabilities in systems proficiency and data governance. The DI era demands management accountants with a deep understanding of front-end business operations and proficiency in financial forecasting and planning, tax accountants skilled in managing automated tax and financial planning systems, and internal audit accountants capable of holistic oversight, comprehensive data analysis, anomaly detection, and verification. Furthermore, this evolution has spurred the emergence of numerous new roles, including Financial Data Analysts, Financial Automation Process Architects, Data Asset Managers, and Intelligent Risk Control Experts. Individuals in these emerging roles require strong business acumen, effective communication and analytical skills, forward-looking strategic thinking, and both rapid adaptability to change and robust change management capabilities. Therefore, within the context of FAE, universities must proactively embrace this trend and dynamically adapt their talent cultivation programs to enhance the core competitiveness of their graduates.

2.3 Composite and Core Competencies

The DI era has shifted the requirements for financial accounting talents from an emphasis on traditional accounting certificates and singular accounting knowledge towards cultivating "T-shaped" talents endowed with both profound accounting expertise and extensive DI skills (Qasim & Kharbat, 2020) [19]. Professional knowledge encompassing accounting standards, tax law, auditing, financial management, and internal control serves as the "vertical axis," establishing a solid foundation in the accounting domain. DI tools, including statistics, data mining, data analysis, and programming techniques, serve as the "horizontal axis," expanding the scope of technological application. The deep integration of these axes forms the core competitiveness of professionals. The composite competency requirements primarily encompass seven dimensions: proficiency in utilizing technological tools such as RPA and BI; adeptness at transforming data into business value; possession of independent critical thinking skills; effectiveness in cross-team collaboration and communication; sustained passion for learning new technologies and methods; the innovative courage to lead financial process transformation; and steadfast adherence to data security and professional ethics principles. Regarding qualification certification, industry demand demonstrates a dual-track characteristic: requiring both traditional financial accounting credentials such as Certified Public Accountant and Association of Chartered Certified Accountants certifications to validate foundational capabilities, alongside digital field certifications such as Certified Data Analyst and Certified Analytics Professional. Within FAE, universities

must move beyond the traditional orientation of overemphasizing credentials at the expense of practical abilities (Brown & Souto-Otero, 2020) [3], optimize the curriculum system, create practical learning scenarios, and effectively enhance students' core competencies to align with the industry's fundamental need for diversely developed and dynamically evolving professionals.

3. Current Status and Limitations of University FAE

3.1 Curriculum-Industry Misalignment

Certain courses remain disconnected from practical applications and have become outdated. Firstly, curricular content is misaligned with the actual demands of industry roles (Mian *et al*., 2020) [14]. Professor Huang Shizhong, President of Xiamen National Accounting Institute, has warned that "accounting may disappear." While tools like financial big data analysis and intelligent risk control systems are ubiquitous in practice, they are rarely integrated into mainstream curricula, with relevant courses offered only at select institutions. Secondly, interdisciplinary teaching modules lack substantive depth (Mokski *et al*., 2023) [15]. Financial work now operates within an integrated "business-finance-technology" framework, yet superficial additions of cross-disciplinary content fail to address DI era talent needs, limiting students' ability to synthesize and apply knowledge. For instance, Python programming instruction should extend beyond basic syntax to include scenario-based case studies involving financial statements and cost budgeting. Thirdly, foundational information technology courses are inadequately covered. Despite pervasive IT adoption, essential courses such as computational applications and data-analytical thinking for accounting students remain either absent or overly rudimentary. This undermines students' long-term career readiness (Caton & Savenye, 2025) [5].

These gaps hinder both industry demand for versatile, practice-ready accounting professionals and students' sustained career development. Learners often lack integrated skills to deploy technological tools in complex financial contexts, struggle to cultivate a holistic "business-finance-technology" perspective, and exhibit deficient problem-solving abilities due to insufficient real-world training. Weak IT foundations create fundamental gaps in digital literacy. Consequently, graduates expend considerable effort acquiring practical tools and adapting to workflows, delaying job readiness and impeding early career efficiency. Long-term, these knowledge and competency deficits—particularly amid digitalization—will limit professional growth and competitiveness. FAE thus struggles to produce the versatile, digitally competent professionals the industry requires.

3.2 Teaching-Resource Lag

FAE suffers from teaching models and resource allocation that lag behind DI transformation, failing to address the core need for cultivating application-oriented, composite professionals. Firstly, pedagogical approaches remain rigid, characterized by low classroom interactivity and student engagement (Neimann *et al*., 2020) [16]. Instruction relies heavily on unidirectional knowledge delivery, lacking practical case studies and empirical analysis. Persistent dependence on purely theoretical exposition impedes students' systematic understanding of financial workflows and undermines practical skill acquisition. Secondly, practical resources at some institutions are inadequate and obsolete, while industry-education integration remains superficial. Outdated laboratory infrastructure and legacy financial software (e.g., older editions still in use) fall significantly behind mainstream cloud-based systems like Kingdee Cloud and Yonyou NC. Industry-university partnerships lack substantive depth (Kleiner-Schaefer & Schaefer, 2022) [11], with internships often restricted to entry-level roles such as cashiers, limiting exposure to core functions like cost accounting, Financial Business Partner, and financial analysis. Thirdly, cultivating "Dual-qualified" teachers faces obstacles (Li & Li, 2022) [12], and industry-education integration is ineffective or absent. A critical shortage exists of "Dual-qualified" teachers combining deep theoretical expertise with substantial industry experience. Most instructors confine their course content to textbook theories, struggling to integrate authentic financial operations scenarios and cutting-edge technological applications into teaching. Consequently, their pedagogical approaches fail to align with the cultivation objectives for application-oriented composite accounting professionals.

These deficiencies collectively erode graduates' applied competencies. Students encounter teaching methods, practical tools, and faculty guidance misaligned with industry advancements, resulting in underdeveloped practical skills. Lecture-based instruction and insufficient case-based or empirical training curtail problem-solving abilities in complex financial contexts. Exposure to obsolete tools and deficient technical practice stifles innovation mindsets and data application skills. Limited core functional experience weakens adaptability to real business scenarios. The dearth of "Dual-qualified" teachers hampers students' ability to dynamically synthesize knowledge and respond to industry shifts. Consequently, graduates often lack hands-on proficiency, struggle to master mainstream tools and processes, and demonstrate low efficacy in resolving practical issues. Amid rapid DI advancement, these competency gaps further constrain technological adaptability and innovation potential, limiting long-term career progression. Thus, outdated teaching models and resource allocation directly hinder the cultivation of critical applied skills, technical acumen, and composite business literacy, creating a disconnect between educational outcomes and the core competency requirements for financial accounting professionals in the DI era.

3.3 Standardized Inflexible Evaluation

FAE evaluation remains overly reliant on single-method examination outcomes, lacking multidimensionality and comprehensiveness. Firstly, assessment mechanisms prioritize final exam scores as the key performance indicator (Guo *et al*., 2019) [10]. Exam structures are formulaic, with content often oversimplified. Questions emphasize rote concept recall and mechanical formula application, neglecting open-ended practical problem-solving. For instance, accounting exams typically require computing solvency ratios via preset formulas but omit industry-contextualized interpretation of underlying business risks, reflecting constrained evaluation scope. Secondly, formative assessment is largely perfunctory (Wang & Han, 2021) [24]. Continuous evaluation relies excessively on routine attendance checks and basic homework tasks. Collaborative exercises like group case analyses lack standardized rubrics, leading to subjective assessments that inadequately measure

collaboration, critical inquiry, innovation, or learning efficacy. Thirdly, evaluations neglect professional practical skills (Bian *et al*., 2022) [27]. Proficiency in digital tools−including financial modeling, BI visualization, advanced Excel functions, and ERP systems−is excluded from competency assessment frameworks. This absence of skill-based evaluation entrenches exam-focused learning, opposing the educational mandate to develop composite application-oriented talents.

The homogeneous evaluation logic in FAE misaligns with digital-era demands for versatile professionals, stifling holistic competency cultivation. The "scores-over-abilities" approach systematically impedes core competency development essential for the DI era. Limited open-ended or analytical questions hinder critical thinking and practical insight needed for nuanced business data interpretation. Superficial process evaluation fails to foster or assess higher-order competencies like collaborative communication, autonomous exploration, and innovative cognition. Omitting practical skill assessment directly weakens digital tool proficiency and real-world problem-solving capabilities. Consequently, students may excel theoretically but demonstrate low practical acumen, technical unfamiliarity, and deficient complex problem-solving skills. In modern workplaces valuing hands-on expertise, collaborative agility, and digital fluency, this "high scores, low competence" outcome diminishes graduates' core competitiveness and career adaptability. This structural deficiency in evaluation obstructs FAE's ability to cultivate the composite application-oriented professionals it aims to produce.

4. DI Era FAE Reform Pathways

To address the constraints of FAE in the DI era, this reform framework aims to cultivate interdisciplinary professionals proficient in integrating theoretical principles, technological applications, and business acumen. The core strategies involve: (1) adopting technology-enhanced, scenario-driven pedagogical innovations; (2) redesigning curricula to harmonize foundational theories with DI tools and industry practices; (3) strengthening University-Enterprise Collaboration through resource-sharing, talent exchange, and outcome-oriented collaboration; (4) advancing faculty proficiency in DI applications; and (5) implementing a three-dimensional evaluation model to assess procedural digitization, comprehensive skill development, and practical certification. Concurrently, the reform prioritizes cultivating innovative thinking and data-driven analytical capabilities, ensuring graduates achieve both academic rigor and technical proficiency. This holistic approach fosters a dynamically adaptive talent cultivation ecosystem aligned with DI advancement. Details are provided in Figure 1.

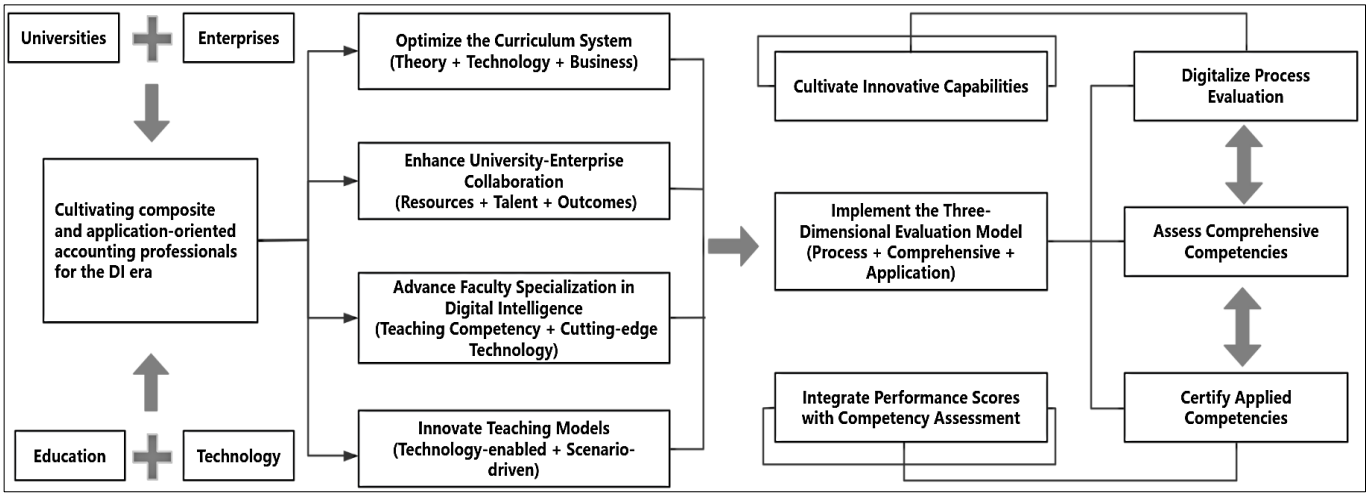

Fig 1: Three-dimensional evaluation model

4.1 DI-Integrated Curriculum Systems

The DI era necessitates shifting curriculum systems from an accounting-focused paradigm to a data value creation-driven approach. Central to this is optimizing curricular content to establish a tripartite framework integrating accounting principles, data technology, and business scenarios. Curriculum knowledge structures should be enhanced (Peng *et al*., 2022) [18] through systematic integration of applied courses such as AI-driven financial tools, intelligent data analytics, and emerging technology practicums, creating a cohesive competency development continuum spanning data collection, cleansing, analysis, and decision-making. Traditional courses must be redesigned with embedded DI modules (Yuliandi & Jalinus, 2024) [28]–for example, incorporating Enterprise Resource Planning (ERP) systems into accounting courses for real-time transaction processing and data analytics, or integrating machine learning into decision-support courses to develop dynamic cost forecasting models. Collaboration with firms such as Deloitte and Yonyou enables the creation of dynamic case repositories featuring specialized scenarios (e.g., "Intelligent Tax Compliance Auditing for Cross-border E-commerce," "Carbon Asset Valuation Modeling for New Energy Firms"), ensuring curricular relevance and practical rigor. Restructuring the "1+X" certification framework (where "1" denotes the academic diploma and "X" represents vocational certificates; Fu *et al*., 2021) [8] to include credentials like Certified Data Analyst and Certified Information Systems Auditor within credit equivalency systems establishes a dual-validation pathway for academic qualifications and advanced DI competencies. These synergistic reforms−curricular refinement, resource enhancement, and certification alignment−effectively bridge the gap between academic content and industry needs, advancing the DI proficiency and core competitiveness of accounting professionals.

4.2 DI Thinking-Practice Pedagogy

FAE must develop an immersive pedagogical ecosystem grounded in technology-empowered and scenario-driven approaches to address DI era imperatives. Technology empowerment utilizes virtual simulation laboratories to replicate dynamic scenarios (e.g., intelligent risk control in supply chain finance, cross-border M&A tax planning), integrating industrial software suites like Power BI visualization and RPA reconciliation. This enables students to develop risk quantification and decision support proficiency through real-time parameter tuning. Scenario-driven pedagogy employs tiered learning scaffolds−such as project-based retail cash flow dashboard development on Kingdee Cloud and open-ended experiential projects like "Competitor Financial Health Analysis Using Web Crawling"−guiding students through heterogeneous data cleansing and insight generation within authentic business contexts. Implementation mechanisms feature innovative Dual-qualified teacher collaboration (Xie, 2022) [25], where industry experts demonstrate operational workflows of intelligent auditing systems while instructors elucidate underlying machine learning algorithms, narrowing industry-academia disconnects. This synergistic coordination of technological platforms, contextual tasks, and faculty expertise systematically cultivates DI tool proficiency, data-informed decision-making capabilities, and emerging business context analysis skills, transforming learners from accounting operators into data value architects.

4.3 DI-Literate Dual-qualified Faculty

Faculty transformation and capability enhancement represent a critical pathway to address the structural imbalance of prioritizing theory over practice in FAE. Building "Dual-qualified" teachers requires systematically advancing applied proficiency in DI tools and practical pedagogical competencies. The "Technical Secondment Program" (Shao & Ni, 2022) [22] should be implemented, enabling teachers to undertake full-time corporate engagements during winter/summer vacations through deep involvement in real-world projects (e.g., intelligent supply chain financial system development), translating frontline technical experience into authentic instructional cases. Teacher evaluation systems must be reformed (Sun & Zuo, 2020) [23] by integrating DI teaching practices and industry technical service outcomes into promotion and appointment criteria, establishing robust policy drivers. A dual-mentor collaborative model should institutionalize adjunct positions for industry experts (e.g., corporate financial digitalization directors) to deliver regular lectures, supplemented by periodic "DI Tools Workshops" to synchronize curricula with technological advancements. Concurrently, teachers' professional sense of mission (Yang & Su, 2025) [26] must be reinforced to consolidate intrinsic motivation for transitioning to "Dual-qualified" status. Industry-academia technology exchange platforms and DI teaching innovation awards can heighten faculty awareness of their pivotal role in developing accounting talents for the DI era. This fosters endogenous drive for proactive technological adoption and pedagogical innovation, sustaining the vitality of "Dual-qualified" teachers' development.

4.4 Industry-Education Integration Platforms

Industry-education integration requires establishing an integrated tripartite mechanism coordinating resources, talent, and outcomes. Resource integration involves collaborating with leading firms (e.g., PwC, Inspur Group) to establish substantive modern industry colleges or joint laboratories. Desensitized corporate databases and intelligent analytical platforms are incorporated as pedagogical resources, strengthening digital foundations for teaching and research. Collaborative talent cultivation leverages these resources through a tiered practice framework: foundational levels focus on procedural operations like RPA enabled invoice processing in financial shared service centers; advanced tiers immerse students as FBP in frontline roles, conducting data-driven operational-financial integration analysis and decision support; elite tiers select students for core enterprise digital transformation projects, leading strategic initiatives such as data asset mapping development and dynamic cost forecasting models. Outcome transformation implements a dual-mentor project system where enterprises propose authentic challenges (e.g., "Dynamic Cost Modeling for New Energy Vehicle Batteries"). Student teams design, develop, and validate solutions under dual mentorship, with outcomes integrated into corporate KPI evaluation frameworks and exemplary solutions implemented for immediate productivity conversion. This cyclical process−where resources enable talent development, talent generates applied outcomes, and outcomes enhance resources−optimizes the industry-education integration value chain, fostering sustainable long-term collaboration.

4.5 Competency-Oriented Evaluation

The evaluation system must adopt a three-dimensional (process-comprehensive-application) model. Process evaluation should be digitalized using technological tools to monitor learning trajectories comprehensively. Learning management systems document critical knowledge construction milestones and reasoning pathways, enabling quantitative analysis of progressive cognitive development. Intelligent algorithms assess the originality and contributions of collaborative deliverables, shifting evaluation focus from terminal outcomes to systematic assessment of cognitive and collaborative capacities during learning, thereby enhancing pedagogical precision. Comprehensive competency assessment requires a framework evaluating professional literacy and DI competencies. Complex scenario-based tasks measure capabilities in multidimensional information synthesis, digital tool utilization, and systemic decision-making, appraising analytical rigor in resolving complex problems within fluid contexts. Professional ethics dimensions are incorporated to measure adherence to ethical boundaries during technology deployment, ensuring holistic literacy evaluation. Applied abilities should be certified through industry-education collaborative mechanisms. Practical performance is integrated into core evaluations, with industry-recognized credentials validating knowledge application and problem-solving proficiency. Increased weighting of practical assessment strengthens theory-practice integration, transitioning evaluation from knowledge-centric to competency-centric approaches to overcome the limitation of prioritizing scores over abilities. Refined competency certification standards for the DI era align graduate capabilities with industry needs, cultivating value-creating, digitally intelligent accounting professionals.

5. Conclusion

The DI era is fundamentally reshaping financial accounting ecosystems, exposing higher education to systemic challenges: curricula lagging behind technological advancements, pedagogical rigidity, faculty DI literacy gaps, and evaluation systems misaligned with competency-based standards. Reforms must prioritize "DI thinking transformation." Curriculum reconstruction forms the foundation through integrating data analysis/applied courses, embedding ERP and machine learning modules into traditional curricula, and co-developing dynamic case libraries with enterprises to establish business-finance-technology integrated knowledge systems. Pedagogical innovation proves critical via virtual simulation laboratories replicating scenarios (e.g., supply chain finance risk control), enterprise data-driven Problem-Based Learning (PBL) projects, and open-ended data mining tasks to transition learners from passive recipients to active creators. Industry-education integration operates as the core driver−industry colleges build shared data repositories, tiered internships align with competency progression paths, and dual-mentor systems facilitate applied outcome translation−resolving isolated curriculum design limitations. Faculty transformation functions as the strategic breakthrough, where technical secondment programs build practical expertise, interdisciplinary teams develop cutting-edge courses, and industry mentors deliver regular instruction to synchronize teaching with industry frontiers. Evaluation reform serves as the guiding framework, implementing digitalized process monitoring, scenario-based competency stress testing, and industry micro-credentials to establish competency-oriented assessment. FAE must shift from accounting skill cultivation to data value creation capability development. Universities can only cultivate versatile professionals with accounting expertise, mastery of data technologies, and strategic business vision−and thus lead DI-driven financial transformation−by constructing synergistic education-technology-industry ecosystems.

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