Advances in Vocational and Technical Education (2025)
Clausius Scientific Press, Canada
DOI: 10.23977/avte.2025.070213
ISSN 2523-5834 Vol. 7 Num. 2

AI-Empowered Construction and Implementation of Digital Intelligence Classroom for the Course "Cross-Border E-Commerce Data Analysis and Application"

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Keywords: AI Empowerment, Digital Transformation, Digital Intelligence Classroom, Cross-border E-commerce, Data Analysis

Abstract: The course Cross-border E-commerce Data Analysis and Application focuses on addressing issues in traditional teaching during the Cross-border E-commerce industry's transformation toward "refined digital operations," such as disjointed talent cultivation, lagging resources, insufficient adaptation to student needs, and rigid integration of ideological and political education. It constructs a three-dimensional solution featuring "positive values infusion, AI empowerment, industry-education integration, and pervasive digitization." Taking "Championing "Smart China" as the main guiding theme, it incorporates cases on compliant overseas expansion and data privacy protection. Empowered by AI, the course builds a knowledge graph for cross-border e-commerce data analysis and an intelligent agent. It develops AI interactive digital textbooks, integrates MOOCs and training platforms to form a multi-dimensional learning scenario of "text-audio-visual-interaction," and dynamically updates resources. Notable practical achievements include: significantly enhanced data analysis capabilities among students, winning national skills competition awards, and the incubation of multiple entrepreneurial teams. This provides a replicable practical path for the digital transformation of vocational education.

1. Introduction

With the vigorous development of China's digital economy and the rapid rise of the cross-border e-commerce industry, the market demand for high-quality digital trade talents with data-driven decision-making capabilities and artificial intelligence application skills has surged [1]. As the main front for cultivating technical and skilled talents, vocational education urgently needs to achieve deep transformation of teaching content and models through digital transformation to bridge the gap between talent supply and industry demand [2]. As a core course for cross-border e-commerce majors, the teaching effect of the course Cross-border E-commerce Data Analysis and Application directly influences the quality of talent cultivation. However, traditional teaching

models face multiple challenges in addressing the industry's rapid changes and learners' diverse needs: curriculum content lags behind industry development and technological advancements, making it difficult to support effective training of data analysis skills; the integration of ideological and political elements in courses is rigid, failing to effectively merge with professional skills to form a synergistic educational force; teaching resources are updated slowly and lack interactivity, affecting learning efficiency and experience. Such situation restricts the achievement of course objectives and urgently requires breakthroughs through systematic teaching reforms.

2. The Industry Context and Pedagogical Challenges Driving Digital Teaching Transformation

The structural disconnect between industry evolution and talent development lies in the cross-border e-commerce industry's shift from "extensive, experience-driven operations" to "precision, data-driven operations." This demands versatile professionals equipped with both data-informed decision-making capabilities and AI technology proficiency. Yet, current teaching practices often suffer from outdated curricula and limited pedagogical approaches, failing to address the industry's escalating talent requirements. With the industry evolving rapidly amid vast data volumes, AI integration becomes imperative—lowering technical barriers to data analytics, alleviating student intimidation toward complex analysis, and enhancing analytical efficiency.

Traditional teaching resources, such as printed textbooks, present adaptation barriers: infrequent updates, inaccessible content, and disorganized layouts. These fail to meet students' appetite for emerging technologies or match the industry's accelerated pace. For instance, data analytics curricula covering data collection, interpretation, and visualization heavily rely on diverse digital tools—forcing students to constantly switch between printed materials and computer software, thereby hampering learning productivity.

The superficial integration of values-based education is equally critical. Cross-border e-commerce involves ethical dimensions like data compliance, user privacy, and cultural sensitivity, demanding strengthened professional ethics and digital citizenship awareness. However, current teaching practices merely layer ideological elements atop technical training rather than weaving them into analytical workflows and tool applications. This prevents students from cultivating genuine compliance awareness and social responsibility—thus failing to deliver the industry-ready professionals embodying both technical proficiency and professional ethics.

3. Constructing the "AI-Enhanced Classroom" for the Course Cross-border E-commerce Data Analysis and Application

To address the new talent development demands arising from the digital transformation of cross-border e-commerce and resolve core issues in traditional pedagogy, this course establishes a unified four-dimensional framework integrating "positive values infusion, AI empowerment, industry-education integration, and pervasive digitization."This approach drives comprehensive reform in content design, instructional processes, and educational models, with implementations as follows:

3.1. Positive Values Infusion: Championing "Smart China" as the Guiding Theme

Amidst the rapid evolution of cross-border e-commerce and growing uncertainties in global trade, businesses increasingly prioritize compliance and brand reputation to build international competitiveness [3]. Against this backdrop, the course not only equips students with professional data analytics skills but also cultivates socialist core values—rule of law, dedication, and integrity—to meet industry compliance requirements. The overarching educational vision of the course is to

"Champion Smart China", emphasizing three core values. Precision & Diligence: optimizing operations through rigorous data analysis; Compliance Adherence: upholding ethical standards in volatile regulatory landscapes; Brand Confidence: advancing Chinese products globally with conviction. By examining China's transformation from "world factory" to "global innovation leader," the course contextualizes digital globalization through: ethical micro-lectures and values-focused animations case studies on moral dilemmas involving data privacy, regulatory compliance, information security, and fair trade.

Through these initiatives, ideological education becomes intrinsically woven into technical training. Students grows not merely as technicians but as ethically grounded pioneers who recognize that operational excellence requires meticulous analytics, unwavering compliance in uncertain global markets, and empowered advocacy for Chinese brands worldwide. This ensures the course transcends mere technical training to shape the responsible digital stewards demanded by the industry.

3.2. AI Empowerment: Seamlessly Integrating AI into Content and Pedagogy

By rapidly analyzing vast datasets and delivering personalized learning experiences, AI technologies provide comprehensive instructional support throughout the educational journey [4]. The AI-powered Cross-border E-commerce Data Analysis and Application course establishes a systematic, intelligent, personalized, and precise teaching system. Through deep integration of AI into content and instructional processes, it cultivates high-caliber digital trade talent equipped with data analytics capabilities and AI proficiency, directly addressing industry demands. Leveraging Chinese AI technologies (e.g., DeepSeek, Doubao, Wenxin Yiyan), the course creates a tripartite intelligent teaching ecosystem "Knowledge Graph + AI Agent + AI Resources", to reduce reliance on instructors' subjective judgment and transcending human cognitive limitations. Key AI implementations include:

Embedding AI Tools in Core Analytics Workflows. Data Collection: Tools like SellerSprite and Octopus replace traditional crawlers, enabling code-free market data harvesting for real-time industry insights. Analysis & Visualization: Students employ Doubao/Wenxin Yiyan for AI-assisted analytics, comparing manual vs. AI-generated outcomes to understand AI's scope and constraints. Optimization: Learners critically evaluate AI-generated recommendations against their own analyses to refine operational strategies and enhance data-driven performance.

Cross-border E-commerce Knowledge Graph. Built upon existing curricula standards and rich resources, the graph structures knowledge along two logical dimensions. Business Process Flow: product selection→promotion→sales→after-sales. Analytics Workflow: data acquisition→ data analysis→data visualization→data optimization. This interlinked knowledge network is embedded within the MOOC platform, allowing students to retrieve concepts on-demand while accessing associated micro-lectures, exercises, case studies, practical tasks, and industry updates, creating personalized learning pathways.

Course-Specific AI Agent. Integrated with the knowledge graph and MOOC platform, the AI Agent provides: 24/7 smart learning companion with emotional support; Intelligent tutoring for problem-solving using chain-of-thought techniques; Practical task guidance and role-playing simulations. Instead of direct answers, the Agent demonstrates reasoning processes to cultivate critical thinking.

AI-Generated Teaching Resources. Digital avatars modeled after faculty members deliver lecture content with consistent teaching styles while allowing real-time adjustments to pacing. These avatars integrate with the AI Agent to create unified learning experiences. Additionally, they generate dynamic resources: Animations demonstrating data processing workflows; Case study

videos showing raw data transformation into business insights; Interactive simulations of cross-border operational scenarios.

Through AI, the course achieves systematic and intelligent knowledge architecture. The integrated Agent-Knowledge Graph-MOOC ecosystem provides personalized guidance and resources, shifting higher education from "one-size-fits-all" to "precision education" [5]. AI-generated resources present complex concepts through intuitive multimedia formats, while the closed-loop "Learn-Practice-Evaluate" cycle boosts student engagement, knowledge retention, and professional competencies, ultimately replacing empiricism with data-driven pedagogy. The whole process of AI empowerment is visually detailed in Figure 1.

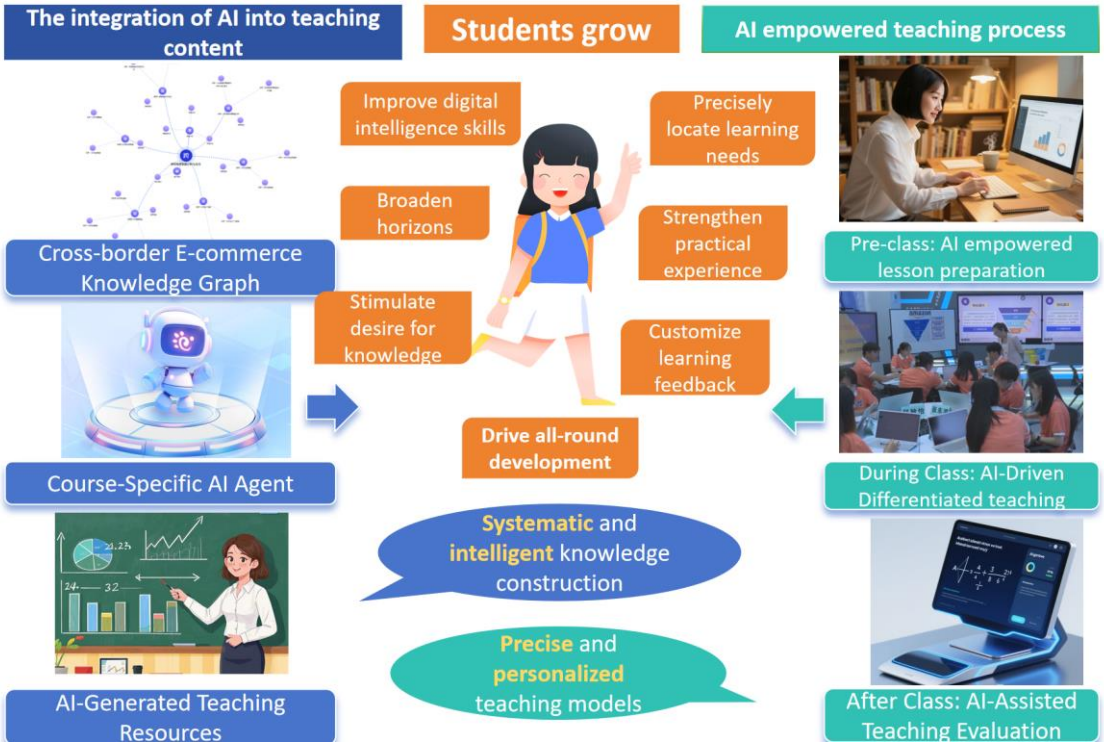

Figure 1 AI Empowered Class Design

3.3. Industry-Education Integration: Building a "Job-Driven + Real-World Practice Oriented" Talent Development Ecosystem

We deepened school-enterprise collaboration by incorporating authentic business scenarios, data, and industry standards into teaching to enhance students' job-targeted skills. Inviting experts from leading cross-border e-commerce enterprises like Pangoo Group and Tomtop Technology, we jointly developed curriculum standards, textbook structures and content based on real industry needs and job processes. Additionally, we created 36 synchronous practical training projects mirroring authentic data analysis workflows in cross-border e-commerce, providing corporate data and operational manuals to ensure seamless alignment between skills and job requirements. From curriculum design to textbook structure and content development, every step embodies industry-education integration. Co-created with industry leaders, our materials ensure training objectives precisely match cross-border e-commerce operational roles and align course design with real-world data analysis processes.

Using 3C electronic products from the Guangdong-Hong Kong-Macao Greater Bay Area as teaching cases, we partnered with leading enterprises to build an industry-education integrated teaching space, bringing real products into classrooms. Students form entrepreneurial teams for

hands-on projects, bridging classroom learning with actual business operations. This approach strengthens professional identity and practical skills, forging an integrated "industry-education-innovation" talent development pathway that shifts pedagogy from theory-dominant to real-job-driven learning. The course implemented a "Dual-Mentor System", which means campus instructors establish theoretical frameworks while industry mentors provide weekly online guidance. Additionally, real-time industry solutions are pushed to address operational challenges.

3.4. Digital Integration: Building a Multi-Platform & Dynamically Updated Resource Ecosystem

We constructed a three-dimensional digital resource architecture centered around a core digital textbook integrated with MOOC platforms and practical training systems, establishing a "Learn-Practice-Create" ecosystem to resolve fragmentation and obsolescence issues in traditional educational resources. By publishing China's first AI-powered cross-border e-commerce textbook Data Analysis and Applications in Cross-Border E-Commerce, we seamlessly embedded 47 instructional videos, 36 hands-on projects, 6 teaching modules, 32 data analysis reports, 14 real-world operational cases, and 174 interactive exercises into the digital learning environment, creating multi-sensory learning experiences through integrated text, audio-visual, and interactive components. The platform incorporates AI-assisted learning features including intelligent keyword search, real-time translation, and automated mind mapping to reduce technical barriers. Each task integrates theoretical knowledge with practical exercises using authentic enterprise data, guiding students through key metric calculations while applying tools like Doubao, SellerSprite, and Octopus for cross-border data collection, pre-processing, analysis, and visualization. Hosted on the national "Zhihui Zhijiao" MOOC platform, the program has served 6,550 learners across 56 vocational institutions, with semesterly updates evidenced by the 2024 additions of "AI Applications in Customer Service Analytics" and "SellerSprite Data Mining Techniques" modules.

4. Outcomes of the Digital-Intelligence Classroom Implementation

Since its 2021 launch, this course has been taught for six rounds for International Business and Cross-Border E-Commerce majors, with four rounds of nationwide MOOC sessions on Zhihui Zhijiao serving over 60 institutions. Key achievements include:

Educational Reform Achievements:The course won the Provincial Gold Medal for Teaching Excellence, Principal’s Quality Award, and university first-class course designation. As a core component of the provincial cross-border e-commerce resource bank and hosted on Zhihui Zhijiao MOOC, it has engaged 6,550 learners across four sessions, while faculty secured two provincial education reform grants.

Career-Embedded Talent Development:Graduates achieved 98% employment with market-recognized data analytical proficiency. Students earned eight national awards including first prizes in the Belt and Road Golden Brick Competition in E-commerce Operations and National Digital Trade Skills Championship, alongside 100% pass rates for 1+X Certifications in E-commerce Analytics and Cross-border B2C Operations.

Entrepreneurial Incubation:The course helped cultivating competencies ranging from digital product selection and cross-platform promotion to profit optimization and livestream strategy design, with five student ventures (e.g., Shenzhen Insight-Tech, Shenzhen Cushan Tech) incubated at the university’s startup base, demonstrating enhanced market acuity and data-driven decision-making capabilities.

5. Conclusion

Addressing talent development challenges in the cross-border e-commerce sector, this study constructs and validates a three-dimensional educational solution featuring "positive values infusion, AI empowerment, industry-education integration, and pervasive digitization." Systematically incorporating values education, intelligent technology, industry resources, and digital ecosystems, this model resolves structural issues in vocational education including curricular obsolescence, instructional misalignment, and fragmented ethical training. Its innovations comprise: reconstructing curricula around authentic industry scenarios; establishing AI-embedded teaching frameworks; creating dynamically updated digital resources; and developing the "Vocational-Curricular-Competition-Certification-Entrepreneurship" pentagon methodology. This practice provides a transferable framework for vocational education digital transformation, demonstrating that next-gen technology-driven reform must rebuild knowledge architectures around industrial demands; Fuse values education with technological enablement; Construct adaptive teaching ecologies; and systematically enhance talent cultivation efficacy, thereby establishing replicable pathways for vocational education transformation.

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