

Paradigm Reconstruction of Tourism Talent Cultivation in the Digital Age: A Theoretical and Practical Path for Teaching Reform Based on Data Empowerment

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Abstract: With the deep integration of the digital economy and new quality productive forces, data has become a core element driving tourism transformation and achieving high-quality development. This trend poses severe challenges to the talent cultivation models in tourism management programs at higher education institutions. Currently, tourism big data education 普遍 faces multiple challenges, including outdated concepts lagging behind industry practices, a curriculum system disconnected from technological advancements, teaching models rigidly adhering to traditional lectures, industry-education integration remaining superficial, and evaluation mechanisms struggling to measure comprehensive competencies. These issues have resulted in a significant structural gap between talent supply and industry demands. This paper adopts "Data-Driven Tourism Innovation" as its core concept and systematically constructs a "Four-Core-Driven" talent cultivation theoretical framework integrating "knowledge-ability-thinking-competence," while proposing a new teaching reform paradigm based on the fundamental principles of "demand orientation, competency-based, scenario-driven, and ethics integration." On this basis, the paper systematically designs a progressive curriculum system featuring "platform-based foundations, modular cores, and project-based applications," explores an immersive teaching model characterized by "virtual-real integration and industry-education collaboration," and optimizes a comprehensive evaluation system emphasizing "process orientation and multi-stakeholder participation." Finally, through in-depth analysis of a practical case involving the reform of the "Big Data Mining and Application" course at a specific university, the effectiveness of this reform path in enhancing students' data literacy, technical application capabilities, and innovative thinking is validated. The research results demonstrate that the teaching reform system constructed in this paper can effectively bridge the industry-education gap, providing a systematic solution with both theoretical depth and practical value for cultivating high-quality interdisciplinary talents in the tourism industry that meet the development requirements of new quality productive forces.

Keywords: tourism big data; teaching reform; data empowerment; new quality productive forces; industry-education integration; talent cultivation

1. INTRODUCTION

The wave of the digital economy is reshaping the global industrial landscape with unprecedented breadth and depth, highlighting the strategic value of data as a new factor of production. The concept of "new quality productive forces" further emphasizes a development direction led by technological innovation, propelling industries towards intelligent, green, and high-end transformation. As a modern service sector highly dependent on information and experience, the tourism industry is at the forefront of this revolution. From the massive user behavior data on Online Travel Agency (OTA) platforms to the complex tourist sentiments expressed on social media, and the real-time operational data from sensor networks in smart destinations, the industry is accumulating vast and multidimensional data assets at an unparalleled rate. Global data volume continues its explosive growth, with tourism-related unstructured and structured data emerging as a "rich information mine" with immense potential for excavation [1, 2]. This data is not merely a digital archive of industry operations but a core driver for innovation, resource optimization, and governance enhancement [3]. Leading international tourism enterprises, for instance, have gained a competitive edge by building data-driven decision-making systems that enable precise management and personalized services, from macroeconomic trend forecasting to micro-level individual tourist experiences [4, 5].

However, a stark contrast exists between the digital transformation on the industry side and the current state of talent cultivation in university tourism management programs. Traditional tourism education has long focused on developing students' skills in planning, operations management, and interpersonal services. While valuable in certain historical stages of industry development, its shortcomings are increasingly exposed in the face of a data-driven industrial ecosystem [6]. Graduates often exhibit significant deficiencies in data acquisition, cleaning, analysis, modeling, and visualization, lacking the data-driven mindset and practical skills to use data for identifying business problems and driving decisions [7]. This lag in knowledge structure and capability models has created a structural disconnect between talent supply and the urgent demand for emerging roles in smart tourism, digital marketing, and revenue management [8]. Therefore, addressing the critical questions of "what kind of tourism talent does the digital age require?" and "how should higher education cultivate such talent?" has become a central issue for the future of tourism higher education. This paper, moving beyond conventional teaching optimization, adopts a systematic and forward-looking perspective to construct a theoretical framework and practical pathway for tourism big data pedagogical reform, aiming to provide theoretical support and a practical model for the profound transformation of tourism higher education.

2. THEORETICAL FOUNDATION AND PRACTICAL CHALLENGES

The core logic for tourism education's response to the demands of new quality productive forces lies in "data empowerment." This concept signifies a shift from viewing data as a byproduct of business activities to recognizing it as a core production asset that, when integrated with other factors, can generate new business models, formats, and momentums [9]. Data empowerment in tourism involves the systematic analysis and intelligent application of massive, multi-source data to optimize the entire value chain, thereby enhancing resource allocation efficiency and total factor productivity [10]. For example, analyzing tourist mobility data allows destinations to achieve dynamic crowd forecasting and intelligent management, significantly improving visitor experience and public safety [11]. Similarly, mining user-generated content from social media enables hotel managers to accurately identify service shortcomings for targeted improvements, thus boosting brand reputation and customer loyalty [12]. Consequently, the fundamental goal of tourism big data education must pivot towards this higher-dimensional philosophy of data empowerment. This requires cultivating "innovators" who can deeply understand tourism business, use a data-driven mindset to discover problems, and leverage data tools to create business and social value, rather than merely training "technicians" proficient in operating specific software [13].

To operationalize this philosophy, this study proposes a "Four-Core Drive" talent cultivation framework centered on the interconnected and spiraling elements of Knowledge, Capability, Mindset, and Literacy. This framework breaks from the traditional linear, discipline-centered model, moving towards a holistic, integrated paradigm focused on students' comprehensive abilities and long-term development. The Knowledge Core serves as the foundation, mandating a cross-disciplinary knowledge system that integrates classic tourism management theories, foundational data science principles, and practical computer science tools [14]. This foundation supports the Capability Core, which is practice-oriented and focuses on developing hands-on skills to solve real-world problems across the entire data lifecycle, from collection and cleaning to analysis, visualization, and modeling. This is best achieved through Project-Based Learning, enabling the transition from "knowing" to "doing" [15]. This practical application, in turn, cultivates the Mindset Core, which aims to internalize data-driven decision-making habits and critical, innovative thinking. It encourages students to "speak with data," fostering a rigorous, objective, and creative professional mindset [16]. Underpinning the entire structure is the Literacy Core, which provides value guidance, focusing on the professional ethics and social responsibilities of future data practitioners. Issues such as data privacy, algorithmic fairness, and information security are paramount, and integrating legal and ethical education is essential to ensure students use data responsibly and for social good [17].

However, the realization of this integrated framework is currently impeded by systemic bottlenecks in tourism big data education. A primary obstacle is a cognitive bias in teaching philosophy, which often reduces the subject to mere software training, emphasizing technical skills over business empowerment and value creation. This is compounded by fragmented and outdated curricula. Course content is often presented as isolated technical points rather than a cohesive workflow, and the technologies taught frequently lag behind industry standards, creating a significant skills gap upon

graduation. Furthermore, traditional pedagogical models, heavily reliant on passive, teacher-centered lectures, fail to provide the immersive, hands-on experience necessary for developing complex problem-solving abilities and collaborative skills. This is exacerbated by a dual constraint on practical resources: a lack of high-performance computing platforms and, more critically, a scarcity of access to authentic, large-scale, and properly anonymized industry data. This "lack of raw materials" forces students to work with overly sanitized and simplistic datasets, inadequately preparing them for the complexities of real-world data and hindering the effectiveness of industry-academia collaboration efforts.

3. A NEW PEDAGOGICAL FRAMEWORK: SYSTEMIC REFORM AND IMPLEMENTATION PATHWAY

To address the aforementioned challenges, this study proposes a comprehensive reform pathway centered on the core principles of demand-orientation, competency-based education, context-driven learning, and ethical awareness. This pathway integrates reforms in curriculum, teaching models, and evaluation systems, aiming to create an open, dynamic, and collaborative educational ecosystem. The primary task is to restructure the curriculum into a progressive, modular system centered on the goal of "data-driven tourism innovation." This system unfolds in three progressive stages: a foundational platform, a modular core, and project-based application. The foundational platform targets lower-year students, aiming to ignite data thinking and introduce basic tools by integrating data-driven industry cases into introductory courses, along with offering foundational classes in statistics, Python programming, and data processing. The modular core is designed for middle-year students, systematically imparting core technologies through course clusters focused on data acquisition and governance, data analysis and mining, and data communication and visualization, utilizing industry-standard tools and methods. The final stage, project-based application, engages upper-year students in integrating and innovating with their acquired knowledge through comprehensive projects that address real-world industry problems, culminating in a capstone project that fully demonstrates their competencies.

This curricular shift necessitates corresponding innovations in teaching models, transitioning from teacher-centered to student-centered approaches to foster initiative, creativity, and collaboration. The widespread adoption of project-based learning (PBL) is central to this transformation, where curricular knowledge is organically woven into complex projects derived from authentic industry needs. In PBL environments, knowledge becomes a tool for problem-solving, and the teacher's role shifts from lecturer to facilitator and coach. The flipped classroom model complements this approach, where students acquire foundational knowledge through digital resources before class, thereby freeing up valuable in-class time for deeper activities such as in-depth case analysis, collaborative problem-solving, and debate over solutions. To support these models, constructing a blended practical environment that integrates virtual and real components is crucial. Virtual simulation labs can provide students with a risk-free environment to practice data-driven decision-making, while deep, sustained partnerships with industry players (such as online travel platforms, hotel groups, and destination management organizations) can offer students exposure to real projects, real data, and real challenges under a "dual-mentor" system.

The effectiveness of this framework was validated through a comprehensive reform of the 48-hour core course "Big Data Mining and Application." The course was redesigned around a real-world project that spanned the entire semester: "Optimizing Service Quality for Chain Economy Hotels Based on Massive User Review Data." The course was restructured into four interconnected modules. The first module, Business Understanding and Data Preparation, included lectures from industry experts and required students to define research questions, and use Python to scrape and clean relevant user review data. The second module, Exploratory Data Analysis and Visualization, required students to use libraries like Pandas and Matplotlib to generate descriptive statistics and visualizations to form initial hypotheses. The third module, Deep Mining and Topic Modeling, constituted the technical core, where students applied natural language processing techniques, such as sentiment analysis and LDA topic modeling, to quantify user sentiment and identify key concerns from textual data. The final module, Business Insights and Value Presentation, required students to use tools like Tableau to create interactive dashboards and write professional consulting reports with actionable recommendations, which they presented to a panel of academic and industry judges.

Inseparable from this pedagogical shift is a reformed assessment system that moves away from a single final exam towards a process-oriented, multi-source evaluation framework. The final grade comprises project proposals, data processing reports, interim models and code, and final presentations and reports, accounting for over 60% of the total score. This structure encourages continuous engagement and deep learning. Furthermore, the assessment incorporates multiple perspectives. In addition to the instructor's evaluation of academic rigor and innovation, it includes peer assessment of teamwork and contribution, as well as feedback from industry mentors on the practical relevance and business value of student solutions. This multi-angle feedback mechanism provides a more comprehensive and accurate measure of students' comprehensive competencies. The reforms have yielded significant positive outcomes: over 90% of students mastered the end-to-end data analysis workflow, student satisfaction with the course significantly increased, and a notable number of the first cohort of graduates secured data-related positions in relevant tourism enterprises, demonstrating enhanced employability and practical skills.

4. CONCLUSIONS AND FUTURE DIRECTIONS

This paper addresses the systemic challenges in contemporary tourism big data education by proposing and validating a comprehensive teaching reform. Its core contribution lies in transcending superficial curriculum adjustments to provide an integrated solution for a fundamental paradigm shift in talent cultivation. The concept of "Data Empowerment" clarifies the ultimate goal of education, while the "Four-Core-Driven" framework provides a systematic, multi-dimensional model for achieving this goal. The practical pathway—comprising a modular curriculum, immersive teaching models, and a multi-source evaluation system—forms a closed-loop ecosystem that deeply embeds industry needs throughout the entire educational process. Compared to existing research, the innovations of this study are threefold: the integration of theoretical concepts such as new quality productivity into a novel "Four-Core-Driven" framework; the systematic and operational design of the reform pathway; and the empirical

validation of the framework's effectiveness through a detailed case study, providing a replicable model for other institutions.

Despite initial success, significant challenges remain. The sustainable and compliant acquisition of high-quality data remains a critical obstacle, necessitating the establishment of robust data-sharing mechanisms that respect privacy and security regulations. Teacher professional development is another key factor; transforming tourism educators into data-science-proficient "dual-qualified" mentors requires substantial and ongoing institutional support and training. Finally, the continuous investment in technological resources, including computing labs and software, poses a tangible constraint, requiring strategic funding allocation by universities.

Looking ahead, the reform of tourism big data education must continue to evolve. Future efforts should focus on establishing regional or national collaborative networks to share resources and best practices; promoting deeper interdisciplinary integration with fields such as artificial intelligence, geographic information systems, and virtual/augmented reality to cultivate cross-domain innovation capabilities. Embracing intelligent teaching tools, such as generative AI, can assist personalized learning and free teachers to focus on cultivating higher-order thinking skills, but this must be coupled with robust AI ethics education. Finally, expanding global perspectives by learning from leading international programs and promoting international cooperation is crucial for enhancing the global competitiveness of tourism education.

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