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The Training Dilemma and Countermeasures of Archival Science Talents under the National Education Digitalization Strategy

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Abstract: Educational digitalization represents a critical strategic direction for comprehensive national development, exerting profound and disruptive impacts across various academic and professional sectors. Archival science constitutes a pivotal domain within the broader field of information resource management. However, traditional talent cultivation approaches in this discipline currently face significant structural and pedagogical challenges amid the rapid wave of digital transformation. Against the overarching backdrop of China's national education digitalization strategy, this paper systematically analyzes the multifaceted challenges encountered in cultivating modern archival science professionals. These challenges include outdated curricula, insufficient technological integration, and a disconnect between academic training and industry demands. To address these critical gaps, this study proposes a series of targeted, forward-looking countermeasures. Specifically, it advocates for establishing a robust "digital + archival" -centric curriculum system that bridges theoretical knowledge with practical technological applications. Furthermore, the paper emphasizes deepening industry-education collaboration to develop integrated digital-intelligence platforms, innovating diversified and interactive teaching methodologies, and implementing comprehensive digital competency enhancement programs for university faculty. Finally, it highlights the necessity of refining institutional support mechanisms and evaluation systems tailored for digital talent development. The primary objectives of this research are to provide actionable, evidence-based insights for the digital transformation of archival science programs, to cultivate highly adaptable archival management professionals equipped with advanced digital skills and innovative thinking, and ultimately to contribute significantly to broader national informatization initiatives.

Keywords: digital education; archival science; talent development; information management; digital transformation

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1. Introduction

The national education digitalization strategy has significantly transformed the landscape of archival science talent cultivation, presenting both opportunities and challenges [1]. This strategy emphasizes the integration of advanced digital technologies, such as data analysis and artificial intelligence, into educational frameworks, thereby necessitating a shift in the skill sets required for archival professionals. To meet these evolving demands, higher education institutions must adopt innovative approaches to curriculum design and pedagogical methods [2]. Archival science professionals are now expected to possess not only traditional expertise in document preservation and management but also proficiency in utilizing cutting-edge digital tools to enhance efficiency and accessibility. Furthermore, the rapid pace of technological advancements requires continuous professional development to ensure that archival science practitioners remain adept at addressing emerging challenges. This paper explores the profound implications of digitalization on archival science education, identifies key

obstacles in talent cultivation, and proposes strategic measures to align educational practices with the requirements of the digital era.

2. The Impact of the National Education Digitalization Strategy on the Archival Science Major

The National Education Digitalization Strategy is a comprehensive initiative designed to address the global digital revolution and transform the education system through advanced technological innovation. Its primary goal is to harness next-generation information technologies, including artificial intelligence, big data, and cloud computing, to create a vertically integrated and service-oriented digital education framework. This strategy aims to ensure equitable access to educational resources, foster innovative teaching methodologies, and enable intelligent advancements in educational governance [3, 4]. Archival science, as a discipline within the social sciences, focuses on the study of archives, archival phenomena, and their operational principles, emphasizing the collection, organization, preservation, and utilization of archival materials. The implementation of this strategy has significantly influenced archival science programs, presenting both opportunities and challenges. On one hand, it has opened new avenues for development by driving the transformation of educational content toward digitalization. This includes the integration of emerging fields such as electronic document management, long-term digital archiving, data analysis and visualization, and digital humanities into academic curricula. Furthermore, the establishment of a national smart education platform and a digital resource repository under this strategy provides extensive teaching cases, data resources, and virtual practice environments, thereby broadening the scope of teaching and research activities. On the other hand, the strategy has introduced challenges by fundamentally altering the objects and environments of archival work [4, 5]. The management, utilization, and security of digital archival resources have become central issues, necessitating rapid adjustments in talent cultivation objectives. This requires the development of interdisciplinary professionals equipped with digital literacy, technical expertise, and data-driven analytical skills. These changes underscore the need for archival science programs to adapt swiftly to the evolving demands of the digital era, ensuring that graduates are prepared to navigate and contribute effectively to this dynamic landscape.

3. Challenges in Talent Development for Archival Science under the National Education Digitalization Strategy

3.1. Weakening of Disciplinary Autonomy

In the context of disciplinary integration within information resource management, archival science faces significant challenges in maintaining its distinct identity. The increasing emphasis on digitalization strategies, which promote interdisciplinary collaboration and technological convergence, has led many universities to shift their focus toward fields such as library and information science or data science. This shift often manifests in curriculum design and research priorities, inadvertently diminishing the unique professional characteristics and theoretical depth of archival science education. As a result, students frequently develop a weakened sense of professional identity with archival science, perceiving it as merely a subset of information management rather than recognizing its critical role in preserving the authenticity of evidence and ensuring the continuity of social memory. This erosion of disciplinary identity not only reduces internal cohesion within the field but also places archival science at a competitive disadvantage when vying for resources and influence against other information-related disciplines. Furthermore, the lack of emphasis on the unique methodologies and principles of archival science risks undermining its ability to address complex challenges in the digital era, such as ensuring the integrity of digital records and safeguarding historical documentation. Addressing these issues requires a concerted effort to reaffirm the value of archival science

as an independent discipline while fostering interdisciplinary collaboration that respects its foundational principles and contributions.

3.2. The Training Program and Curriculum System Are Relatively Outdated

Many universities' archival science programs currently face significant challenges due to outdated curricula and teaching frameworks that are misaligned with the rapidly advancing digital landscape and China's national digital education strategy. These programs continue to emphasize traditional archival management processes, which, while foundational, fail to adequately address the growing importance of modern technological advancements. Key areas such as big data analytics, artificial intelligence applications in archival management, blockchain-based evidence preservation, and digital preservation technologies remain underrepresented or insufficiently explored within the curriculum. This lack of modernization creates a substantial gap between theoretical instruction and practical application, as well as between technical training and professional demands. Consequently, students are not equipped with the integrated skill sets required to navigate the complexities of contemporary archival practices. For instance, the absence of a cohesive competency framework that combines archival expertise with IT and data technology skills leaves graduates ill-prepared for emerging roles in electronic document lifecycle management, digital archive system development, and archival data governance [6]. This disconnect between academic preparation and industry requirements undermines the effectiveness of talent cultivation programs, limiting graduates' ability to contribute meaningfully to the evolving archival industry. Addressing these deficiencies is critical to ensuring that archival science education remains relevant and capable of producing professionals who can meet the demands of a digital-first era.

3.3. Superficial Integration of Industry and Education, Insufficient Cultivation of Practical Skills

The integration of industry and education within archival science often lacks depth, with initiatives primarily focused on surface-level activities such as establishing internship bases and organizing academic exchanges. These efforts frequently fail to establish sustainable mechanisms for deep collaboration or to foster integrated talent development. Advanced practices essential for modern digital strategies, including smart archives, digital humanities projects, and data mining, are rarely systematically incorporated into undergraduate or graduate curricula. Practical training opportunities are often limited to traditional museum visits or basic operational tasks, which do not adequately prepare students for the complexities of real-world digital archival management systems. This narrow scope of training restricts students' exposure to practical problem-solving scenarios and collaborative project environments. As a result, graduates frequently lack proficiency in digital skills, the ability to work effectively in team-based projects, and the innovative problem-solving capabilities required to address contemporary societal needs. The absence of comprehensive, hands-on training hinders the development of a workforce equipped to meet the demands of an increasingly digitalized archival landscape [6].

3.4. Insufficient Digital Teaching Capabilities of Faculty Teams

The faculty in archival science is currently grappling with significant challenges in adapting to the demands of digital transformation. A notable issue lies in the rigid knowledge frameworks of many educators, particularly senior professors, who often lack the necessary understanding and proficiency to effectively utilize emerging digital technologies, tools, and innovative teaching methodologies. This limitation is compounded by the fact that, while some universities have made efforts to recruit younger faculty members with backgrounds in science, technology, engineering, and mathematics (STEM), there remains a pronounced shortage of professionals who can seamlessly integrate advanced digital technologies with foundational archival science theories. This gap in faculty expertise not only restricts the ability to update curricula but also stifles pedagogical innovation. Consequently, students are deprived of opportunities

to develop robust digital literacy skills, which are increasingly essential in the modern academic and professional landscape. Addressing this competency gap is critical to fostering a more dynamic and future-ready educational environment in archival science.

4. Talent Cultivation Strategies for Archival Science Majors under the National Education Digitalization Strategy

4.1. Establishing a Curriculum System with "digital + Archives" Characteristics

Higher education institutions should prioritize the development of a curriculum system that integrates "digital + archival science" characteristics, moving beyond the traditional combination of archival science courses with management and history disciplines. This approach emphasizes the inclusion of digitalized courses rooted in data science and information technology to meet the demands of the evolving digital era. Core curriculum digital transformation requires iterative updates to flagship courses such as Archives Management, Electronic Document Management, and Archival Conservation Technology. For example, Archives Management should incorporate a "Digital Data Governance" module that systematically addresses data classification, metadata standards, quality assessment, and security strategies. Similarly, Archival Conservation Technology should expand its focus from physical media preservation to long-term digital preservation strategies, including advanced topics such as format migration, simulation technologies, and blockchain-based evidence storage. New courses should integrate knowledge from data science, artificial intelligence, and cybersecurity fields to equip students with cutting-edge skills. Examples include "Archival Data Analysis and Visualization," which trains students to extract insights from archival data and create graphical representations using programming languages like Python and R, and "Digital Humanities and Archival Resource Development," which guides students in applying text mining and GIS technologies for comprehensive historical archive analysis. To optimize course structures, modularized course modules should be implemented. For instance, the curriculum could feature three core modules: the "Archival Data Governance Module," which includes courses on data ethics, data standards, and data auditing; the "Archival Intelligent Technology Application Module," which covers topics such as natural language processing in archival cataloging and image recognition and restoration techniques; and the "Archival Service Innovation Module," which focuses on user experience design, digital storytelling, and social media archive management. This modular framework ensures a transformative shift in students' knowledge structure, enabling them to evolve from traditional "archival custodians" to modern "archival data managers" and "archival information architects." By fostering interdisciplinary expertise and digital proficiency, this curriculum prepares graduates to address the challenges and opportunities of the digital age effectively.

4.2. Deepening Industry-Education Integration to Jointly Build a Digital and Intelligent Practice Platform

To deepen the integration between industry and academia, practical teaching should transition from surface-level collaborations, such as field visits and short-term internships, to more comprehensive partnerships that encompass joint construction, management, and evaluation. Institutions should aim to establish hybrid platforms that combine physical and virtual elements to enhance the learning experience. For instance, universities can collaborate with developers of archival software and cloud service providers to create innovative facilities like "Smart Archives Simulation Labs" or "Archival Data Governance Sandboxes" on campus. These platforms can deploy real-world electronic archive management systems and digital repository tools to simulate the complete lifecycle of archival data. This includes processes such as electronic document capture, classification, authentication, long-term preservation, and utilization, all conducted through immersive simulations that mirror real-world operations. Universities can also partner with provincial or municipal archives, corporate archives, and technology firms to establish "Archival Data Innovation Centers." These centers can focus on real-world projects, such

as quality control for digitized collections, optical character recognition (OCR) and proofreading of historical archives, thematic database development, and the design of visualization dashboards. Students can work in project teams under the guidance of corporate mentors and academic advisors, with their deliverables directly benefiting the partner organizations. Additionally, national platforms for archives administration can facilitate remote participation in regional seminars on digitalization and standard-setting meetings. Qualified institutions may also establish secure remote access mechanisms with advanced digital archives, enabling students to access metadata catalogs of exemplary repositories. This allows them to analyze the architectures and service models of these repositories, gaining valuable insights into best practices and innovative approaches in the field. Such initiatives ensure that students are well-prepared for the demands of the digital and intelligent archival landscape.

4.3. Innovative and Diversified Teaching Methods and Models

In teaching practices, innovative methodologies and models should be adopted to establish a student-centered, competency-driven blended learning system [7–9]. This approach emphasizes the integration of project-based learning with case studies through cross-semester project designs that address real-world challenges. Examples include projects such as "building corporate digital memory systems," "developing electronic document archiving solutions for major events," and "strategies for managing social media archives." Educators are encouraged to provide up-to-date case libraries, such as challenges in electronic certificate archiving under municipal e-government platforms, to guide students through collaborative activities. These activities may include conducting feasibility studies, selecting appropriate technologies, designing processes, and delivering mock presentations. Industry experts should actively participate in evaluating the outcomes of these projects to ensure practical relevance and quality. Flipped classroom approaches and peer teaching methods can be particularly effective for technical topics, such as "archive metadata standards" and "digital preservation technologies." Pre-class micro-lectures serve as a valuable tool for self-study, enabling students to grasp foundational concepts before engaging in classroom sessions focused on group discussions, problem-solving exercises, and practical simulations. For instance, students may analyze the OAIS reference model in comparison to actual digital archive systems and perform hands-on demonstrations to deepen their understanding. Online open courses and virtual simulation experiments should be extensively utilized, incorporating national and provincial-level premium online course resources as supplementary materials or elective modules. The "academic mentor + industry mentor" dual guidance model is highly recommended, assigning both institutional academic advisors and industry experts from archives and data management enterprises to each student. Industry mentors play a crucial role by delivering regular lectures, guiding students in practical projects, and assisting with career planning. Additionally, they may provide short-term on-site learning opportunities to enhance students' practical experience and professional development. This comprehensive approach ensures that students are well-prepared to meet the demands of the evolving field of archives and data management.

4.4. Implementation of a Digital Competency Enhancement Program for Faculty Teams

The digital transformation of faculty teams plays a pivotal role in enhancing the quality of talent cultivation within the field of archival science. To achieve this, it is essential to implement systematic and tiered capacity-building programs tailored to the needs of faculty members. Regular professional development workshops should be conducted to familiarize educators with emerging technologies, including big data, artificial intelligence, blockchain, and cloud computing, and their applications in archival practices. The training content must prioritize practical applications, offering modules such as "Fundamental Python Applications in Archival Data Analysis" and "Model Training for Machine Learning in Automated Archival Classification." Faculty members should be encouraged to pursue digital certifications, such as Data Governance Specialists and Information Security Engineers, to strengthen their technical expertise.

A faculty rotation system should be established to facilitate exchanges between academic institutions and industry partners. This system would allow educators to engage in full-time or part-time practical experiences at digital archives, archival technology companies, or government big data centers every three to five years. During these rotations, faculty members should undertake real-world projects to gain a comprehensive understanding of industry challenges and technical solutions. These experiences can then be translated into teaching cases and research topics, enriching the academic curriculum [10, 11].

Interdisciplinary teaching and research teams should also be formed, fostering collaboration between archival science faculty and experts from fields such as computer science, data science, and design. These teams can jointly apply for cross-disciplinary research projects and co-develop innovative curricula. To further incentivize faculty teams, dedicated funding programs should be established to reward outstanding achievements in teaching reforms within the "digital + archives" interdisciplinary domain. Such initiatives would create a positive feedback loop, encouraging continuous improvement in digital competencies and fostering a culture of innovation and excellence in archival science education.

4.5. Improving the Support and Evaluation Mechanisms for Digital Talent Cultivation

At the institutional level, the establishment of a "Digital Archival Education Reform Steering Committee" under the leadership of the dean is essential to effectively coordinate efforts in curriculum innovation, platform development, and faculty training. This committee should operate based on clear policy documents that outline phased objectives, delineate responsibilities, and allocate resources strategically. To strengthen external support, partnerships with industry associations and leading enterprises should be cultivated, ensuring a stable and collaborative network. Financial and resource allocation mechanisms must be enhanced by creating dedicated funding streams for "Digital Archival Talent Development." These funds should support the establishment and maintenance of high-level laboratories, procurement of specialized software, acquisition of data resources, and active student participation in digital innovation competitions. Additionally, faculty research on digital education reforms should receive sustained financial backing. Efforts to secure external funding should be intensified, leveraging opportunities such as the Ministry of Education's Industry-Academia Collaboration Program and scientific projects initiated by the National Archives Administration.

In terms of evaluation systems, a multi-dimensional and dynamic assessment framework should be implemented. Curriculum assessments need to shift away from rote memorization, placing greater emphasis on practical components such as project reports, system prototyping, data analysis reports, and solution demonstrations. The adoption of a "Digital Portfolio" evaluation model is recommended, requiring students to compile comprehensive digital project portfolios as evidence of their competencies upon graduation [12]. Furthermore, a graduate tracking mechanism should be established to monitor and evaluate graduates' adaptability to digital work environments, their technological innovation capabilities, and their problem-solving skills. Regular employer surveys should be conducted to gather feedback on these aspects. Industry experts should be actively involved in revising talent development programs, reviewing course syllabi, and participating in graduation project defenses. This ensures that evaluation criteria remain closely aligned with the evolving demands of the industry, fostering a robust and relevant talent pipeline.

5. Conclusion

The cultivation of archival science professionals is essential for addressing the dynamic needs of society and ensuring the continuous improvement of archival service quality. As digital transformation reshapes the landscape of information management, archival disciplines must adopt innovative approaches to talent development. This includes designing curriculum systems that are closely aligned with the demands of the

digital era, emphasizing hands-on practical training to bridge the gap between theoretical knowledge and real-world application, and enhancing the digital competencies of faculty members to effectively guide students in mastering emerging technologies. Furthermore, the establishment of comprehensive support frameworks and rigorous evaluation mechanisms will ensure the sustained effectiveness of these initiatives. By implementing these strategies, archival programs can produce a new generation of professionals who possess advanced digital skills, creative problem-solving abilities, and a forward-thinking mindset. These professionals will play a pivotal role in advancing the digitalization of education systems and fostering the growth and modernization of archival services, ultimately contributing to the broader development of information management practices in the digital age.

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