

# Exploration of Innovative Management Mode of Electronic Teaching Archives in Smart Campus

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**Abstract:** A smart campus leverages modern information technologies to enhance teaching, management, and service, creating an efficient, interactive, and personalized educational environment. With the rise of electronic teaching documents, innovative management is crucial to preserve academic archives. This study examines the current state and challenges of electronic document management in universities through questionnaire surveys and data analysis. Findings highlight key issues and offer practical insights for improving electronic document practices in higher education. The research emphasizes the need for innovative solutions to ensure the completeness and reliability of academic records.

**Keywords:** Teaching Archives; Electronic Files; Archiving Work; Intelligence; Blockchain Technology

## 1. Introduction

Teaching archives are a type of archive and a component of school archives. Similar to administrative archives, they are true historical records with reference value and credentialing functions. They play a supportive role in a school's teaching quality, evaluations, experiences, and philosophies. Improving teaching archives ensures the normal operation of teaching management. Due to the unique time segmentation, scattered document sources, diverse material formation, and complex and rich content of teaching archives, converting paper teaching documents to electronic documents helps extend the lifespan of archives and maximize their value.

In an intelligent education environment, the modes of teaching activities in higher

education institutions have undergone significant changes. Course selection, scheduling, grades, student status, and textbook management systems have become widespread, with electronic documents, CDs, and multimedia formats becoming important channels for storing academic information[1]. The achievements of universities in teaching management, teaching practice, and teaching research are objectively reflected in the archives, embodying the hard work and wisdom of numerous educators. In the context of promoting smart campuses, the management of teaching archives needs to adapt to the development of the times.

It distributed 400 questionnaires to universities in Shandong Province and received a 100% response rate, with an effective rate of 66.31%, using the "self-management questionnaire survey method." The digitization of teaching archives is a crucial part of the informatization process in higher education. Data analysis clearly reflects the technological transformation from traditional paper-based teaching archives to electronic formats, highlighting the urgent need for an overall transformation in management models, teaching methods, and even educational philosophies. By innovating management models, It can improve educational quality, optimize campus management, and enhance the working and learning environment for teachers and students, ultimately achieving educational modernization.

## 2. The Importance of Electronic Teaching Archives in University Archives Management

In the term "electronic archives," the emphasis on "electronic" signifies that these archives are generated and processed

through digital technology, possessing digital characteristics and attributes[2]. This includes formats such as electronic documents, databases, emails, electronic images, and incorporates elements like timestamps, electronic seals, and digital signatures[3]. These stored electronic records are distinct from paper-based archives formed, processed, and filed using non-electronic equipment. Electronic archives offer durability and stability, mitigating issues like damage and loss that are common with paper archives, thereby ensuring the completeness and security of the archive content.

Failure to innovate and prioritize the management of electronic documents can compromise the integrity of teaching archives. Therefore, it is essential to timely initiate the archiving of electronic teaching archives. This involves formulating corresponding archiving management guidelines and matching regulations, clearly outlining the scope, methods, timing, and procedures for archiving electronic teaching documents. Such measures ensure the integrity of teaching archives and the clarity of educational "memory." Table 1 demonstrates the common types of electronic teaching archives in use.

**Table 1. Electronic Types of Teaching Archives**

Serial number	Types of electronic archives	Proportion
1	Text	87%
2	Data table	53%
3	Demo file	68%
4	image file	66%
5	Audio files	45%
6	video file	33%
7	Compress files	75%

Electronic teaching archives can be efficiently managed through information technology, facilitating the storage, retrieval, sharing, and utilization of archives, thus enhancing the efficiency and accuracy of archive management. Firstly, the digitization and electronic processing of teaching archives should be well-planned and purposeful. Before conversion, a thorough analysis of all teaching archives is necessary[4]. Based on the specific value of the archives, a plan should be formulated to

determine which archives should be prioritized and which can be processed gradually. Generally, teaching archives that require permanent or long-term preservation, such as those related to admissions management, student status management, degree work, and graduate work, should be prioritized for digitization. Examples include student admission lists, grade sheets, graduation qualification review forms, and degree archives, which are the focus of the electronic processing of teaching archives. Highly utilized teaching archives should be digitized as they are used; this scan-as-you-go approach is an effective method for handling archives. Damaged or aging archives should also be included in the digitization process, undergoing electronic processing while being repaired to preserve archival information resources. Secondly, standards and regulations for the digitization of teaching archives must be established, with uniform standards and specifications[5]. This is particularly important for standardizing the digitization process, ensuring that workflows for scanning, image processing, data entry, text and image editing, and storage formats are strictly followed. For instance, all supporting documents for electronic teaching files and documents expressing their format and related metadata must adhere to these standards. Electronic archives can integrate teaching resources scattered across different departments and individuals, helping to form a comprehensive and systematic library of teaching resources, providing important references for teaching and research. It is possible to quickly and accurately query the required information through a database management system, saving time and labor costs, and improving work efficiency [6]. Electronic archives provide rich teaching data and historical records, which help educational administrators analyze and make decisions, improve teaching management, and enhance teaching quality. Adopting electronic file management can reduce the use of paper, lower office costs, and meet the requirements of environmental protection and energy conservation. The electronic archive system supports remote access, making it convenient for teachers,

students, and administrators to access archive information at different locations and times, improving the flexibility of work and study.

### 3. Methods for Converting and Archiving Electronic Teaching Records

In the process of informatization, the storage, parameter indicators, and media formats of digital archives must adhere to national standardized formats. When creating electronic teaching archives, it is crucial to maintain the completeness of their metadata and background information. The basic process of digitizing paper archives mainly includes file arrangement, catalog database creation, batch scanning, data processing, information storage, and retrieval utilization. Documents should be organized before scanning according to requirements, with the scanned content including file covers, internal catalogs, internal file materials, and examination sheets. Generally, common image formats such as JPG or GIF are chosen, with a resolution of at least 200 dpi and a color depth of over 24 bits.

Different methods of electronic conversion are used for different archival content: manual keyboard entry, machine scanning input, and computer multimedia input. The foundational catalog database, student records, grades data, and other indexed files are input manually. For original files and

full texts, such as comprehensive teaching files, student records including admission forms, transcripts, and graduate photos, scanning or digital photography is used to store them in the corresponding database in graphical form. Multimedia teaching videos are converted using computer multimedia processing methods. When selecting electronic database format standards, it is best to use unified and commonly used file formats.

Archiving electronic documents involves many considerations. For instance, accessing and utilizing archived electronic teaching documents directly via computer terminals may not pose issues when the media are online. This method can be divided into two specific forms: network transmission archiving and media transfer archiving. The former refers to transmitting electronic teaching documents that meet archiving conditions through the network to designated nodes of the archival management institution, where they are stored on the institution's media. Media archiving involves storing electronic teaching documents on a certain physical medium according to the archival management institution's requirements, and then transferring them to the institution.

Due to the current unresolved security issues with electronic files, schools may consider adopting the physical archiving method and should pay attention to backups.

**Table 2. Conversion and Use of Electronic Archives**

Serial number	Electronic conversion method	Proportion
1	Scanning and Digitization	24%
2	Data entry and indexing	44%
3	Document Management System (DMS)	56%
4	Cloud storage solution	22%
5	Data backup and disaster recovery plan	34%

From Table 2, it is evident that there are many issues encountered during the conversion and archiving of electronic documents. The archiving of electronic teaching documents should begin with necessary front-end control measures to ensure the completeness, standardized format, and adequate backup of the documents.

First, all paper documents are typically converted into digital form using scanners. This includes course plans, exam records,

student assignments, meeting minutes, and so on. Archived electronic documents generally go through cataloging and appraisal, which are necessary to ensure the historical authenticity and quality of the archived electronic teaching documents.

Second, after scanning, data entry is performed to create indexes, enabling users to quickly find the required documents. The archived electronic teaching documents must be accompanied by the "Electronic Teaching Document Archival Transfer

Inspection Form" and the "Teaching Document Archival Reception Inspection Registration Form."

Third, the archived electronic teaching documents should be comprehensively collected. A specialized document management system should be used to store, manage, and protect electronic documents[7]. All electronic teaching documents included in the archiving scope must be promptly transferred to the school's archival management institution. These systems usually have advanced search functions, version control, and access control. Given the strong system dependency of electronic teaching documents, it is crucial to thoroughly collect relevant supporting software and data documents during the archiving process; otherwise, the archived electronic teaching documents might become inaccessible.

Fourth, the electronic processing must comply with relevant education and privacy laws, such as GDPR or FERPA. The archived electronic teaching documents must be authentic and valid. In addition to the "dual-archiving system" that archives paper documents simultaneously, teaching units with the necessary conditions can also use electronic digital signature technology, watermarking technology, and encryption technology to confirm the validity of electronic teaching documents. Appropriate security measures, such as encryption, access control, and regular security audits, should be implemented.

Fifth, ensure that all electronic archives are regularly backed up, and a disaster recovery plan is established to prevent data loss or system failure. To ensure the security and reliability of archived electronic teaching documents, schools using physical archiving methods should implement multiple sets of preservation for electronic teaching documents. Generally, teaching archives can be archived in two copies: one for use and one for record-keeping. All logically archived electronic teaching documents should be shared as information resources.

#### **4. Intelligent Development of Electronic Teaching Archive Management Mode**

In the context of smart campus development, the management model of electronic teaching archives is gradually innovating towards intelligence[8]. Currently, many universities have implemented electronic management of teaching archives, but numerous issues persist. For instance, data security and privacy protection problems are increasingly prominent, and ensuring that sensitive information is not leaked has become a crucial concern for managers. Moreover, with the surge in data volume, effectively organizing, storing, and retrieving massive amounts of data is a significant challenge. Additionally, the interoperability and standardization of electronic archive systems among different universities vary, which to some extent limits the sharing and optimal allocation of teaching resources.

**Table 3. Management Mode of Electronic Teaching Archives**

Serial number	Pattern analysis	Proportion
1	Data silos	41%
2	Data analysis utilization rate	22%
3	System security	45%
4	Standardization of supporting facilities	56%
5	Improved rules and regulations	53%
6	Full time staff	34%
7	Staff functional literacy	46%

From Table 3, it is clear that the phenomenon of data silos is severe, with a lack of correlation and compatibility between different departments or organizations, leading to ineffective data connection and interaction. This results in difficulty sharing data between different

systems. There is a lack of effective data analysis and mining, causing the value of the data to be underutilized. System security and privacy protection measures are inadequate, and there are potential risks due to incomplete regulations and policies. Additionally, there is a shortage of

dedicated staff with a certain level of informatization literacy.

In addressing these issues, the application of intelligent technologies offers solutions[9]. Technologies such as artificial intelligence, big data analysis, and cloud computing are being introduced into electronic archive management systems. Intelligent algorithms can conduct in-depth analysis of teaching data, thereby supporting teaching reforms and decision-making. Meanwhile, the use of cloud computing platforms makes data storage more flexible and cost-effective, facilitating data sharing across campuses and regions[10].

In the future, the management model of university teaching electronic archives will continue to evolve towards intelligence. On one hand, artificial intelligence technologies will further optimize search algorithms, enhancing retrieval efficiency. On the other hand, there will be increased investment in data security and privacy protection, employing more advanced encryption technologies and access control strategies. Additionally, to improve system interoperability, establishing unified data standards and exchange protocols will be an inevitable trend.

## 5. Innovative Strategies to Improve Existing Models

### 5.1 Data Integration and Sharing

Establish a unified data platform to achieve data interoperability between different systems. Adopting standardized data formats and exchange protocols to promote data sharing between schools. By utilizing cloud computing technology, electronic teaching records can be stored in the cloud. This not only greatly saves local storage space, but also improves the convenience and security of file access. The efficient backup and recovery mechanism provided by cloud computing can effectively prevent file loss and damage. Through cloud storage solutions, teaching records can be accessed and managed from any device and location, greatly improving the flexibility of access and the scalability of the system.

### 5.2 Intelligent processing

Introduce artificial intelligence technologies such as natural language processing and machine learning to achieve automatic archiving and intelligent retrieval. Utilizing big data analysis technology to intelligently manage electronic teaching records, providing a basis for teaching reform through in-depth analysis of teaching data. For example, using natural language processing (NLP) technology to automatically identify document content and classify tags. It can also be used to predict the usage trend and user demand of archives, thereby optimizing resource allocation. Develop advanced search algorithms and recommendation systems to help users quickly find the desired files, and automatically classify and label file content based on users' search habits and access history through natural language processing technology; Utilize machine learning algorithms to analyze archival data, identify potential issues in the teaching process, and propose improvement suggestions. Augmented Reality (AR) and Virtual Reality (VR): Utilizing AR and VR technologies to provide a more intuitive and interactive access experience in specific scenarios, such as the display of historical archives or scientific research data.

### 5.3 Security and Privacy Protection

Strengthen the security management of electronic teaching archives, adopt encryption technology and access control mechanisms to ensure the security of archive data during transmission and storage. At the same time, in accordance with relevant laws and regulations, strict privacy protection policies are formulated to protect the privacy of archive information, safeguard the personal information of teachers and students from being leaked, and prevent data leakage and abuse.

### 5.4 The Application of Blockchain Technology

Utilizing the decentralization and immutability of blockchain technology to achieve distributed storage and management of electronic teaching records [11-12]. Blockchain technology can improve the security and transparency of archival data,

prevent tampering and forgery, and is particularly suitable for storing and verifying important documents such as transcripts and certificates. This not only enhances the credibility and reliability of archives, but also facilitates academic and professional background checks.

## **6. Conclusion**

The innovative management model for electronic teaching archives in a smart campus environment has made significant progress in improving archive management efficiency, enhancing information retrieval speed, and ensuring archive security. However, there are still some shortcomings in the current management model. For example, some schools lack unified archive management standards and norms, resulting in inconsistent data formats and retrieval difficulties. Additionally, the intelligence level of archive management systems needs improvement to fully meet the increasingly complex management needs. Furthermore, the varying professional quality and technical proficiency of archive management personnel also affect management effectiveness.

In the future, the management model for electronic teaching archives should develop towards standardization, intelligence, and specialization. Specific recommendations include establishing and promoting unified electronic archive management standards to ensure consistent data formats across various archives; enhancing the intelligence of archive management systems by utilizing artificial intelligence and big data technologies to achieve automated classification, retrieval, and analysis functions; and improving the professional skills of archive management personnel through regular training and assessments to enhance their mastery and application of new technologies. These measures can further optimize the management model of electronic teaching archives, ensuring the integrity, reliability, and efficiency of teaching archives in a smart campus environment.

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