

Integrating Preventive and Curative Preservation Strategies: Enhancing Archival Education for Sustainable Cultural Heritage Learning

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ABSTRACT:

This study examines the integration of preventive and curative preservation strategies in supporting archival education and sustainable cultural heritage learning. The purpose of this research is to analyse how preservation practices contribute not only to the sustainability of archival materials but also to the development of professional competencies and educational processes within archival institutions. A qualitative descriptive method was employed, using interviews, observation, and document analysis. Data were collected from ten archivists at the Semarang City Archives and Library Office, which serves as the research site. The findings reveal that preventive and curative preservation strategies are implemented through a combination of technical and educational practices, including encapsulation, fumigation, restoration using Japanese tissue, digitisation, and digital storage systems. These activities function as experiential learning processes that enhance archivists' practical skills, digital literacy, and decision-making abilities. In addition, institutional training programmes, community guidance, archival exhibitions, and public services contribute to knowledge transfer and informal learning for various stakeholders. The study also highlights the role of institutional

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support, infrastructure, and human resources in strengthening both preservation and educational outcomes. Archival preservation is shown to function not only as a technical necessity but also as an educational platform that supports lifelong learning and cultural heritage awareness. The integration of physical and digital preservation practices further enhances accessibility and sustainability. This research concludes that combining preventive and curative preservation strategies contributes significantly to archival education and sustainable cultural heritage learning. The findings provide empirical evidence that archival institutions can serve as both custodians of heritage and active learning environments for professional and public education.

Keywords: archival education, preservation strategies, preventive conservation, curative conservation, cultural heritage learning, archival sustainability.

INTRODUCTION

Archives play a fundamental role not only as repositories of historical records but also as dynamic resources for education and knowledge transmission. In contemporary contexts, archives are increasingly recognised as learning environments that support the development of historical awareness, critical thinking, and information literacy. The integration of archival practices into educational frameworks enables students, professionals, and communities to engage with authentic sources, thereby strengthening cultural understanding and lifelong learning. As a result, archival institutions are no longer viewed solely as custodians of records, but also as active contributors to educational processes and knowledge production.

Archival preservation, traditionally focused on safeguarding physical and digital materials, is now closely linked to educational objectives. Preservation activities ensure that archival materials remain accessible for teaching, research, and public learning. Preventive and curative preservation strategies, in particular, provide not only technical solutions for maintaining archival integrity but also practical learning opportunities for archivists and learners. Preventive preservation aims to minimise risks and avoid damage through environmental control and proper storage, while curative preservation focuses on repairing and restoring damaged materials (D'Orazio et al., 2023; Wang et al., 2023). These practices can serve as

experiential learning tools that enhance professional competencies in archival science.

The growing emphasis on archival education highlights the need to integrate preservation knowledge into training programmes and institutional practices. Archivists are required to develop a diverse set of competencies, including technical skills, digital literacy, and decision-making abilities related to preservation strategies. Educational initiatives in archival institutions, such as workshops, training sessions, and community outreach programmes, play a crucial role in transferring this knowledge. These initiatives not only strengthen institutional capacity but also contribute to broader societal awareness of the importance of preserving cultural heritage. In addition, the rapid development of digital technologies has transformed both archival practices and educational approaches. Digital preservation has become a key component of archival sustainability, ensuring long-term access to information in digital formats. At the same time, it introduces new learning dimensions, requiring archivists and learners to understand digital systems, metadata management, and technological infrastructure (Barrueco & Termens, 2022; Shekgola & Ngoepe, 2025). The integration of digital tools in archival education supports the development of digital competencies that are essential in the modern information landscape.

Despite the recognised importance of preservation and education, existing studies tend to examine

these aspects separately. Many studies focus on technical preservation challenges, such as environmental risks, material degradation, or technological obsolescence, without addressing their educational implications. Conversely, research on archival education often emphasises curriculum development and user engagement but pays limited attention to how preservation practices can function as learning resources. This separation creates a gap in understanding how preservation strategies can be utilised to enhance educational outcomes and professional training in archival contexts (Arumugam et al., 2025; Lian & Xie, 2024).

Furthermore, institutional factors such as organisational support, resource availability, and policy frameworks significantly influence both preservation practices and educational activities. Effective archival education requires not only well-designed learning programmes but also adequate infrastructure, skilled human resources, and supportive governance structures. Studies have shown that institutional capacity plays a crucial role in sustaining archival practices and knowledge systems, particularly in the context of digital cultural heritage (Fenlon et al., 2025). However, the relationship between institutional support, preservation strategies, and educational outcomes remains underexplored.

Addressing this gap requires an integrated perspective that connects preservation practices with educational objectives. Preventive and curative preservation strategies can be understood not only as technical interventions but also as pedagogical tools that facilitate experiential learning, skills development, and knowledge transfer. Through hands-on activities such as archive repair, environmental monitoring, and digitisation, learners can develop practical competencies while contributing to the sustainability of archival collections. This approach aligns with contemporary educational paradigms that emphasise active learning and real-world application.

Therefore, this study aims to analyse the integration of preventive and curative preservation

strategies in enhancing archival education for sustainable cultural heritage learning. By examining institutional practices, resource conditions, and educational activities within an archival institution, this research seeks to demonstrate how preservation strategies can support both archival sustainability and educational development. The findings are expected to contribute to the advancement of archival education by providing an empirical framework that links preservation practices with learning processes, professional training, and community engagement.

LITERATURE REVIEW

1. Archival Preservation in Contemporary Contexts

Archival preservation is a fundamental function of archival institutions, ensuring that records remain accessible, authentic, and usable over time. Preservation encompasses a wide range of activities, including storage management, environmental control, and the application of appropriate conservation techniques. In traditional settings, preservation focuses on maintaining the physical condition of paper-based materials, whereas in digital environments, it involves managing file formats, metadata, and technological infrastructures that support long-term access (Henderson & Lingle, 2025). The shift from analogue to digital archives has significantly expanded the scope of preservation, requiring institutions to adopt hybrid approaches that address both physical and digital vulnerabilities. The sustainability of archival preservation is closely linked to the ability of institutions to respond to evolving risks, including environmental threats, technological obsolescence, and organisational limitations. Climate change, for example, has increased the frequency of disasters that threaten archival collections, highlighting the importance of proactive preservation planning (Wessell & Thorpe, 2023). In addition, the increasing volume of digital records presents challenges related to storage capacity, system maintenance, and data security. These complexities require preservation strategies that are not only technically sound but also adaptable to changing conditions.

2. Preventive and Curative Preservation Strategies

Preservation strategies are commonly categorised into preventive and curative approaches. Preventive preservation focuses on reducing the risk of damage before it occurs by controlling environmental factors such as temperature, humidity, light exposure, and air quality. It also includes proper handling procedures, storage systems, and disaster preparedness measures. These actions are designed to minimise deterioration and extend the lifespan of archival materials without direct physical intervention. In contrast, curative preservation involves direct intervention to repair or stabilise damaged materials. Techniques such as cleaning, deacidification, lamination, and the use of specialised materials for restoration are commonly employed to restore the usability of archives. The selection of appropriate curative methods depends on the type and extent of damage, as well as the material characteristics of the archives (Safarov et al., 2023). While curative actions are essential for recovering damaged records, they are often more resource-intensive than preventive measures, making it necessary to balance both approaches effectively.

Strategic integration of preventive and curative preservation is considered essential for achieving long-term sustainability. Institutions must prioritise preventive measures to reduce the need for costly repairs while maintaining the capacity to perform curative interventions when necessary. This balance requires careful planning, resource allocation, and the development of standardised procedures that guide preservation activities.

3. Digital Preservation and Technological Integration

The advancement of digital technologies has transformed archival preservation practices, introducing new methods for storing, managing, and accessing information. Digital preservation involves processes such as digitisation, format migration, emulation, and the implementation of secure storage systems to ensure long-term accessibility. These practices are critical for

preserving born-digital materials as well as for creating digital surrogates of physical archives. Technological integration also supports the development of more efficient preservation systems. Automated monitoring tools, digital repositories, and cloud-based storage solutions enable institutions to manage large volumes of data while maintaining security and accessibility. However, digital preservation also presents challenges, including rapid technological change, software dependency, and the risk of data loss due to system failures (Cramer et al., 2023). Addressing these challenges requires continuous updating of technical skills and institutional strategies.

4. Archival Education and Professional Competencies

Archival education plays a crucial role in preparing professionals to manage preservation activities effectively. The increasing complexity of archival work demands a combination of theoretical knowledge and practical skills, including an understanding of preservation principles, digital technologies, and risk management. Education and training programmes are essential for developing these competencies and ensuring that archivists can adapt to evolving professional requirements. Professional development in archival settings often involves experiential learning, where individuals gain hands-on experience through direct engagement with archival materials and preservation processes. This approach allows learners to apply theoretical concepts in real-world contexts, enhancing their problem-solving abilities and technical expertise. Training initiatives may include workshops, on-the-job training, and collaborative projects that facilitate knowledge exchange among professionals.

In addition to formal education, archival institutions play a significant role in informal learning and public education. Outreach programmes, exhibitions, and community engagement activities provide opportunities for broader audiences to learn about archival practices and the importance of cultural heritage preservation. These initiatives contribute to raising

awareness and fostering a sense of shared responsibility for preserving historical records.

5. Institutional Capacity and Educational Support Systems

The effectiveness of both preservation and educational activities is strongly influenced by institutional capacity. Factors such as organisational structure, policy frameworks, funding availability, and human resources determine the ability of institutions to implement sustainable preservation strategies and educational programmes. Strong institutional support enables the development of integrated systems that combine preservation practices with training and knowledge dissemination. Collaboration between institutions also plays an important role in strengthening archival education and preservation efforts. Partnerships with government agencies, educational institutions, and community organisations facilitate the sharing of resources, expertise, and best practices. These collaborations enhance the overall effectiveness of archival systems and support the development of more comprehensive and inclusive approaches to preservation and education.

Despite growing recognition of the importance of integrating preservation and education, there remains a need for empirical studies that examine how these elements interact in practice. Understanding how preservation strategies can function as educational tools is essential for developing more effective approaches to archival management and cultural heritage learning. This study addresses this gap by exploring the relationship between preservation practices, institutional capacity, and educational outcomes in an archival context.

RESEARCH METHODS

This study employed a qualitative research design with a descriptive approach to explore how preventive and curative preservation strategies contribute to archival education and sustainable cultural heritage learning. A qualitative approach was considered appropriate because it allows for an in-depth understanding of institutional practices, professional experiences, and learning processes

within archival environments. The study focuses not only on the technical implementation of preservation strategies but also on their role in facilitating knowledge transfer, skills development, and educational engagement. The research was conducted at the Semarang City Archives and Library Office, a regional archival institution that actively implements preservation programmes and educational outreach activities. This site was selected due to its comprehensive archival services, including physical and digital preservation, community guidance programmes, and training initiatives for various stakeholders. These characteristics make the institution a relevant case for examining the intersection between archival preservation and educational practices.

Data were collected through multiple qualitative techniques, including semi-structured interviews, direct observation, and document analysis. Semi-structured interviews were conducted with ten archivists who are directly involved in preservation activities. These informants were selected using purposive sampling based on their roles, experience, and involvement in both preservation and educational activities. The interviews explored not only technical aspects of preventive and curative preservation but also the ways in which these practices support learning processes, professional development, and public education. In addition to interviews, direct observations were carried out to examine preservation practices and educational interactions within the institution. Observations focused on activities such as archive handling, restoration processes, environmental control, digitisation procedures, and training or guidance sessions conducted by archivists. This approach enabled the researcher to capture real-world practices and understand how preservation activities function as experiential learning opportunities for both professionals and the public.

Document analysis was also employed to support data triangulation. Relevant documents included institutional policies, preservation guidelines, training materials, and reports related to archival activities. These documents provided additional insights into the organisational framework,

educational programmes, and strategic priorities of the institution, particularly in relation to capacity building and knowledge dissemination.

Data analysis followed an interactive model consisting of data reduction, data display, and conclusion drawing. In the data reduction stage, raw data from interviews, observations, and documents were organised and coded to identify key themes related to preservation strategies and educational practices. The data were then presented in a structured manner to facilitate interpretation, focusing on patterns such as skill development, knowledge transfer, and institutional learning processes. Finally, conclusions were drawn by synthesising the findings and linking them to the research objectives and existing literature. To ensure the credibility and validity of the findings, this study applied data triangulation by comparing information obtained from different sources and methods. Member checking was also conducted by confirming key findings with selected informants to ensure the accuracy of interpretations. These strategies enhance the trustworthiness of the research and provide a more comprehensive understanding of how preservation strategies contribute to archival education.

Overall, this methodological approach enables the study to capture the dual function of archival preservation as both a technical practice and an educational process. By integrating multiple data sources and focusing on real-world institutional contexts, the research provides a holistic analysis of how preventive and curative preservation strategies support sustainable cultural heritage learning.

RESULTS

1. Preventive and Curative Preservation as Experiential Learning Practices

The findings indicate that preventive and curative preservation strategies implemented at the Semarang City Archives and Library Office function not only as technical procedures but also as experiential learning practices for archivists. Activities such as encapsulation, fumigation, environmental control, lamination, and the use of Japanese tissue for restoration provide hands-on

learning opportunities that enhance practical competencies. Archivists develop skills through direct engagement with archival materials, allowing them to understand the characteristics of different types of archives, including textual, cartographic, photographic, and audio-visual records.

Preventive preservation activities, such as regulating temperature, humidity, and lighting, as well as controlling dust and pests, require archivists to apply theoretical knowledge in real-world contexts. Similarly, curative actions, including cleaning, repairing tears, and restoring fragile documents, enable archivists to gain technical expertise through practice. This combination of preventive and curative approaches supports the development of professional skills and reinforces learning-by-doing as a key component of archival education.

2. Development of Professional Competencies through Preservation Activities

The implementation of preservation strategies contributes significantly to the development of archivists' professional competencies. These competencies include technical skills in archive handling and restoration, analytical skills in identifying types of damage, and decision-making abilities in selecting appropriate preservation methods. For example, archivists must assess whether archives require encapsulation or restoration using Japanese tissue, depending on their condition and value. In addition, archivists develop competencies related to digital preservation through activities such as scanning, media transfer, and digital storage management. The use of cloud-based systems and digitisation programmes enhances their digital literacy and technical adaptability. These skills are essential in contemporary archival work, where digital and physical preservation practices are increasingly integrated.

3. Institutional Training and Knowledge Transfer Mechanisms

The Semarang City Archives and Library Office plays an active role in facilitating training and knowledge transfer through structured guidance and assistance programmes. The institution

conducts archival training activities twice a year for regional organisations, community groups, and other stakeholders. These programmes include guidance on archive management, preservation techniques, and proper handling procedures. The training activities are delivered through both formal and informal communication channels, including direct visits, workshops, and digital communication platforms. Archivists provide hands-on guidance by visiting institutions and communities, enabling participants to learn directly from practical demonstrations. This approach supports the transfer of knowledge and skills beyond the institution, contributing to the broader development of archival competencies in the community.

4. Archives as a Medium for Public Education and Cultural Learning

The study reveals that archival institutions also function as spaces for public education and cultural learning. The Semarang City Archives and Library Office organises exhibitions and provides archival services that allow the public to engage with historical records. These exhibitions serve as informal learning platforms where visitors can gain knowledge about archival materials, historical events, and cultural heritage. In addition, the institution offers free archive repair services to the public, which not only address preservation needs but also raise awareness about the importance of maintaining personal and community records. Through these services, the public gains insights into preservation practices, fostering a greater appreciation for archival materials and their cultural significance.

5. Digital Preservation as a Platform for Digital Learning

Digital preservation initiatives within the institution contribute to the development of digital learning environments. Programmes such as archive digitisation, scanning, and cloud-based storage systems require archivists to engage with digital technologies and develop relevant technical skills. The Early Archive Awareness system, implemented by the institution, supports the conversion of physical archives into digital

formats, enhancing accessibility and long-term preservation. These digital activities not only improve archival management but also serve as learning platforms for archivists and stakeholders. The integration of digital tools encourages the development of digital competencies, which are increasingly important in the management of cultural heritage. This highlights the role of digital preservation as both a technical process and an educational resource.

6. Institutional Support and Learning Environment

The effectiveness of preservation-based learning is influenced by institutional support, including organisational structures, policies, and resource availability. The Semarang City Archives and Library Office operates under a formal regulatory framework and is supported by infrastructure such as archive storage systems, restoration tools, and digital technologies. These resources create a conducive learning environment where archivists can develop and apply their skills. However, the findings also indicate some limitations, such as incomplete facilities and budget constraints, which may affect the extent of preservation and educational activities. Despite these challenges, the institution continues to implement preservation programmes and training initiatives, demonstrating its commitment to both archival sustainability and educational development.

7. Community Engagement and Lifelong Learning

The study shows that archival preservation activities contribute to lifelong learning by engaging various community groups, including schools, local organisations, and public institutions. The Semarang City Archives and Library Office provides guidance and assistance to these groups, helping them manage and preserve their archives effectively. Through these interactions, community members gain practical knowledge and skills related to archival management. This process fosters a culture of learning and shared responsibility for preserving cultural heritage. The involvement of diverse stakeholders highlights the role of archival institutions as centres for

community education and knowledge dissemination.

DISCUSSION

This study demonstrates that preventive and curative preservation strategies extend beyond their technical functions and play a significant role in supporting archival education and sustainable cultural heritage learning. The findings reveal that preservation activities at the Semarang City Archives and Library Office function as experiential learning processes, enabling archivists and stakeholders to develop practical competencies through direct engagement with archival materials. This supports the view that professional knowledge in archival science is not only acquired through formal instruction but also through practice-based learning embedded in institutional activities. The integration of preventive and curative strategies provides a comprehensive learning framework that combines theoretical understanding with hands-on application. Preventive measures, such as environmental control and risk mitigation, require analytical thinking and planning skills, while curative actions, including restoration and repair, demand technical precision and material knowledge. The interaction between these approaches fosters holistic learning, allowing archivists to understand the full lifecycle of archival preservation. This finding aligns with experiential learning perspectives, where knowledge is constructed through active participation and reflection on real-world tasks.

Furthermore, the study highlights the importance of institutional training programmes as mechanisms for knowledge transfer and capacity building. The regular guidance and assistance activities conducted by the institution illustrate how archival knowledge can be disseminated beyond professional archivists to include government agencies, community organisations, and the general public. These initiatives contribute to the development of a broader learning ecosystem in which archival education is not confined to formal academic settings but is integrated into community-based practices. This expands the role of archival institutions as

educational actors that facilitate both professional development and public learning.

The findings also emphasise the growing significance of digital preservation as a component of archival education. The implementation of digitisation programmes, media transfer, and cloud-based storage systems requires archivists to acquire digital competencies that are essential in contemporary information environments. These activities create opportunities for technology-based learning, where individuals develop skills related to digital tools, data management, and information systems. As a result, digital preservation not only enhances archival sustainability but also supports the development of digital literacy, which is increasingly recognised as a key competency in the modern era.

In addition, the study demonstrates that archival institutions can serve as platforms for informal and lifelong learning. Public services such as archival exhibitions, repair services, and community outreach programmes enable individuals to engage with archival materials and gain knowledge about cultural heritage. These activities foster awareness of the value of archives and encourage community participation in preservation efforts. The involvement of schools, local organisations, and public institutions further strengthens the educational impact of archival practices, promoting a culture of shared responsibility for preserving historical records.

However, the effectiveness of archival education through preservation practices is influenced by institutional capacity and resource availability. The findings indicate that factors such as infrastructure, funding, and human resources play a crucial role in shaping both preservation activities and learning opportunities. While the institution studied demonstrates a strong commitment to integrating preservation and education, limitations in facilities and budget constraints may affect the scope and quality of these initiatives. This suggests that strengthening institutional support is essential for maximising the educational potential of archival preservation. This study contributes to the literature by bridging the gap between archival

preservation and archival education. Previous research has often treated these domains separately, focusing either on technical preservation strategies or on educational frameworks without considering their interconnection. By providing empirical evidence from institutional practice, this study shows that preservation activities can function as effective educational tools that support skill development, knowledge transfer, and community engagement. This integrated perspective offers a new approach to understanding archival sustainability, where technical and educational dimensions are mutually reinforcing.

Overall, the discussion highlights that integrating preventive and curative preservation strategies creates a dual benefit: ensuring the physical and digital sustainability of archives while simultaneously enhancing educational outcomes. Archival institutions, therefore, have the potential to act not only as custodians of cultural heritage but also as active learning environments that contribute to professional training and public education. Strengthening this dual role can support the development of more sustainable and inclusive archival systems in the future.

CONCLUSION

This study demonstrates that preventive and curative preservation strategies are not only essential for maintaining the physical and digital integrity of archival materials, but also serve as

meaningful components of archival education. The implementation of these strategies at the Semarang City Archives and Library Office shows that preservation activities—such as encapsulation, restoration, digitisation, and environmental control—function as experiential learning processes that strengthen archivists' technical competencies, digital literacy, and professional decision-making skills. In addition, the findings confirm that archival institutions play an important role as educational spaces through structured training, community guidance, and public engagement activities. These initiatives facilitate knowledge transfer between professional archivists and various stakeholders, including government institutions, schools, and the wider community. As a result, archival preservation practices contribute to both formal and informal learning processes, supporting cultural heritage awareness and lifelong learning.

Overall, the integration of preventive and curative preservation strategies enhances archival sustainability while simultaneously strengthening archival education. This study highlights the importance of viewing archival institutions not only as custodians of cultural heritage but also as active learning environments. Future research may further explore how structured archival education models can be developed to maximise the educational potential of preservation practices in different institutional contexts.

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