2nd INNOVEX 2026 - International Conference
Website:
ISBN: **-**

USABILITY OF AI-ENABLED MEDICAL INFORMATICS REPOSITORY FOR ACCELERATED CLINICAL RESEARCH ACCESS

Dotillos, C.F.N.[1]*, Martinez, K.S.[2], Ceniza J.P.[3], Pongasi I.T[4]

[123]Bachelor of Science in Information Technology, Southwestern University PHINMA (Philippines)
[4]College of Information Technology, Southwestern University PHINMA (Philippines)

*Corresponding email: tselsiedotillos@gmail.com

ABSTRACT

This study evaluated the usability of an AI-ready, web-based Digital Research Repository developed for the Southwestern Medical Center Research Department to mitigate research access delays, physical document degradation, and administrative communication gaps. Utilizing an explanatory sequential mixed-methods design, the study established baseline metrics from 32 resident doctors, engineered the system using user-centered design principles, conducted task-based usability evaluations, and administered the System Usability Scale (SUS) paired with qualitative interviews. Pre-implementation diagnostics revealed prominent baseline barriers, specifically in document organization and storage security (M = 4.20, SD = 0.57) and document location latency (M = 3.80, SD = 0.57), culminating in an overall baseline mean friction score of 3.80 (SD = 0.51). Post-implementation usability testing yielded a composite SUS score of 72.5 (SD = 7.07), outperforming the standard industry benchmark of 68.0 and positioning the platform firmly within the acceptable, "Good" usability classification. Qualitatively, clinical practitioners reported drastically accelerated file retrieval speeds and structurally clearer archive navigation, while noting minor recommendations for loading optimization and real-time request-status indicators. These findings demonstrate that deploying structured, AI-ready data layers effectively resolves localized knowledge-management friction, establishing a scalable infrastructure that prepares traditional medical clinical archives for future intelligent systems integration, natural language processing, and advanced semantic discovery.

***Keywords**: AI-ready digital repository, research accessibility, medical informatics, usability testing, Human-Computer Interaction (HCI), System Usability Scale (SUS).*

1. INTRODUCTION

Digital repositories are increasingly used to organize, preserve, and provide access to scholarly outputs in academic and healthcare settings because they improve retrieval, strengthen preservation, and reduce the structural limitations of physical archives [1], [2]. In modern healthcare environments, these systems serve as foundational infrastructure for medical informatics, transitioning institutions from passive storage spaces to active knowledge ecosystems that empower medical innovation. To foster rapid clinical advancement, resident doctors and medical researchers require instant, unhindered access to case reports, localized theses, and clinical references to support evidence-based medicine and accelerate institutional research productivity [2].

However, at the Southwestern Medical Center Research Department, institutional knowledge has traditionally been managed through legacy physical storage systems, which require manual index searching, mandatory on-site access, and complex administrative coordination [2]. This traditional configuration introduces systemic inefficiencies, including critical delays in locating vital data, communication barriers in requesting access, and heightened risks related to physical file deterioration or unauthorized handling [2]. As institutional research activity accelerates, these localized data silos create severe friction in data discoverability. This bottlenecks academic output and prevents the department from effectively leveraging its clinical data assets for advanced technological integration, data mining, or automated discovery.

This study addresses these clinical informatics barriers by conducting a comprehensive usability evaluation of an

AI-Ready Digital Research Repository developed specifically for the Southwestern Medical Center Research Department. By configuring the repository to be "AI-ready"—utilizing standardized data structures, machine-readable metadata, and centralized web-based architectures—the platform establishes the digital baseline required to support future automated data parsing, semantic discovery, and intelligent information retrieval. Ultimately, this system aims to empower medical informatics by providing an optimized pathway toward accelerated clinical research access.

Specifically, this study seeks to identify the systemic challenges associated with legacy physical storage, determine the user-centered design frameworks and functional features needed to establish an AI-ready repository system, and empirically evaluate the implemented platform in terms of user accessibility, data retrieval efficiency, and user satisfaction [2]. In doing so, this research provides a practical, scientific assessment of how a highly optimized repository can empower medical research management, minimize cognitive friction for clinical practitioners, and prepare institutional medical knowledge for an increasingly AI-driven research landscape [2], [3].

A. Challenges in Physical Storage of Academic and Clinical References

Traditional shelves and file rooms for medical theses, dissertations, and clinical references are increasingly unable to keep pace with exponentially growing research outputs [1]. Limited spatial capacity, overcrowded stacks, and manual paper-based tracking slow down information retrieval and increase the risk of misplaced, fragmented, or incomplete records [2]. Furthermore, physical storage locks valuable clinical data in isolated silos. Access is usually restricted to on-site visits and rigid operational hours, which is highly impractical for Resident Doctors who require real-time, data-driven evidence for clinical interventions and immediate academic work [2]. Physical collections are also highly vulnerable to environmental deterioration and loss, while their maintenance demands significant physical space, staffing, and operational budgets—making purely physical systems unsustainable for modern medical institutions seeking to cultivate a culture of rapid innovation [3].

B. Digital Repositories as a Foundation for AI Readiness and Research Access

Digital repositories respond to these infrastructure challenges by centralizing institutional research outputs on secure, web-based platforms that support remote, asynchronous access [1], [2]. Beyond simple digitization, modern repositories act as the primary engine for research empowerment by employing structured metadata, standardized schema mapping, robust search filters, and role-based access permissions [3], [4]. This structured organization is precisely what renders an informatics database "AI-ready." By transforming raw, unorganized paper text into highly discoverable, machine-parsable knowledge blocks, the data is prepared to seamlessly interface with future natural language processing (NLP) models, large language models (LLMs), and intelligent sorting algorithms.

Institutional deployments demonstrate that digital repositories drastically enhance research visibility, global data preservation, and service efficiency compared with traditional stacks [5]. Usability evaluations, commonly utilizing the System Usability Scale (SUS), further demonstrate that repositories achieve maximum utility, rapid user adoption, and long-term viability when they prioritize intuitive navigation layouts, clean visual design hierarchies, and responsive, low-latency performance [6], [7].

C. Design Frameworks, Intelligent Systems, and Localized Knowledge Gaps

Recent digital repository designs are heavily shaped by User-Centered Design (UCD) methodologies, which promote iterative system development based directly on user workflows and are formalized in international standards such as ISO 9241-210 [8], [10]. To ensure long-term utility and seamless interoperability with emerging artificial intelligence tools, modern platforms align their architectures with the FAIR (Findable, Accessible, Interoperable, Reusable) and TRUST (Transparency, Responsibility, User focus, Sustainability, Technology) frameworks [4], [6].

Advanced informatics implementations increasingly incorporate semantic search capabilities, algorithmic relevance ranking, and scalable cloud architectures to optimize discoverability and handle complex, natural-language query intents [9]. However, while contemporary literature heavily details

repository deployments in large, well-funded western universities, there remains a distinct scarcity of empirical evidence evaluating repository usability within medical training environments in the Philippine context [2], [3]. This study directly addresses this critical localized gap, demonstrating how medical research centers can build compliant, accessible, and AI-ready infrastructures to accelerate clinical research access and empower local medical innovation.

2. IMPLEMENTATION METHOD

To establish a rigorous, empirical examination of system performance, this study utilized an explanatory sequential mixed-methods research design [14]. This scientific framework systematically integrates quantitative diagnostic evaluations with qualitative analytical indicators to investigate organizational performance and technological readiness before and after system deployment [14]. The research architecture models the systematic constraints inherent within a decentralized, legacy archiving system and quantifies the informatics optimization achieved through the execution of a web-based, AI-ready digital repository [2].

The empirical boundaries of this investigation are defined within the specialized medical training and clinical research department of the Southwestern Medical Center Research Department[2]. Given the finite, highly specialized, and critical nature of institutional stakeholders who interact with clinical references, case profiles, and active research theses, a total population sampling strategy was applied [11], [12]. The primary sample cohort comprised 32 Resident Doctors (n = 32), achieving a 100% enumeration rate of the target user base [11], [12]. This total sampling methodology eliminates sampling variance and guarantees that the resulting primary dataset accurately represents institutional research demand, operational realities, and knowledge-retrieval patterns within the medical center [12], [14].

System Architecture and Development Methodology

The technical engineering and systemic execution of the Digital Research Repository platform were guided by an iterative User-Centered Design (UCD) framework [8], [10]. This methodology prioritizes clinician workflows at every lifecycle stage, ensuring that the software environment directly remediates the specific accessibility and document-management vulnerabilities discovered during baseline diagnostics [3], [15].

Crucially, to support the conference theme of empowering innovation through artificial intelligence, the underlying system architecture was engineered to establish an AI-ready data infrastructure. The repository incorporates highly structured, schema-mapped metadata models, standardized JavaScript Object Notation (JSON) structures, and machine-readable document tagging pipelines. This advanced indexing configuration transforms unstructured clinical files into unified, high-quality data layers capable of seamlessly interfacing with future automated text-mining tools, semantic search algorithms, and natural language processing (NLP) models.

Furthermore, the system integrates robust role-based access control (RBAC) security schemas and a secure, chat-mediated document requisition pipeline to safeguard sensitive medical knowledge [2], [15]. These functional specifications were systematically engineered to align institutional research assets with international FAIR (Findable, Accessible, Interoperable, Reusable) and TRUST (Transparency, Responsibility, User focus, Sustainability, Technology) digital data preservation standards, thereby modernizing the institution's informatics infrastructure for future AI integrations [4], [6], [7].

Research Procedures

The structural execution and data collection protocol for this investigation were conducted through seven distinct, systematic phases:

1. Baseline Diagnostic Assessment: Validation and distribution of a primary psychometric instrument to evaluate the legacy physical archive across four distinct operational dimensions: access efficiency, document location latency, resource request communication barriers, and file integrity/security parameters [13], [14]. Prior to data collection, formal institutional approval and Institutional Review Board (IRB) clearance were officially obtained through the college's review committee to guarantee full ethical compliance. Secure informed consent procedures were strictly enforced before engaging participants; all 32 resident doctors received explicit descriptions regarding data utilization,

volunteer rights, and identity anonymization protocols before completing any diagnostic evaluations or task-based sessions.

2. AI-Ready System Requirements Synthesis: Translation of identified baseline operational pain points and document retrieval bottlenecks into actionable functional and non-functional software specifications. This phase mapped required user interfaces to the necessary backend data structures required for automated, intelligent information parsing [2], [3].
3. Iterative Platform Engineering: Technical deployment of the web-based repository platform, incorporating advanced search indexing, unified data schemas, user role permissions, and request-tracking modules in strict adherence to institutional data governance standards [4], [15].
4. Controlled Usability Testing: Execution of task-based interaction sessions where the target user cohort (n = 32) performed standardized operations under timed conditions, including multi-criteria literature searches, machine-metadata viewing, and restricted file requisitions [9], [15].
5. Post-Implementation Usability Evaluation: Immediate administration of the standardized 10-item System Usability Scale (SUS) psychometric questionnaire to mathematically capture user perception, learnability, and overall platform compatibility with clinical workflows [6], [7], [9].
6. Qualitative Key-Informant Requisition: Conduct of semi-structured interviews and open-ended text analyses to capture narrative insights regarding user navigation pathways, interface ergonomics, and technical system bottlenecks [8], [14].
7. Mixed-Methods Data Integration: Triangulation of descriptive statistical properties (SUS scores) with qualitative thematic matrices to contextualize user interactions, validate usability indices, and generate objective design recommendations for expanding the repository's intelligent, AI-driven capabilities [9], [14].

3. RESULT AND DISCUSSION

This section presents the empirical findings derived from the two-phase evaluation of the institutional research infrastructure at the Southwestern Medical Center Research Department. The analysis sequentially contrasts the functional limitations of legacy physical operations against the usability and architectural performance of the newly deployed digital platform [2], [14]. Quantitative indices from baseline diagnostic tracking and post-implementation System Usability Scale (SUS) assessments are synthesized with qualitative data compiled from semi-structured user interviews to provide a comprehensive analysis of the system's impact on clinical informatics workflows [6], [14]. Collectively, these findings evaluate the organizational transition from decentralized, unstructured physical storage to a centralized, user-centered digital repository engineered to optimize research accessibility, prepare institutional data for machine-readability, and accelerate knowledge discovery within a medical training environment [2], [10].

A. Pre-Implementation Survey on Physical Research Storage

This section presents the empirical findings derived from the two-phase evaluation of the institutional research infrastructure at the Southwestern Medical Center Research Department. The analysis sequentially contrasts the functional limitations of legacy physical operations against the usability and architectural performance of the newly deployed digital platform [2], [14]. Quantitative indices from baseline diagnostic tracking and post-implementation System Usability Scale (SUS) assessments are synthesized with qualitative data compiled from semi-structured user interviews to provide a comprehensive analysis of the system's impact on clinical informatics workflows [6], [14]. Collectively, these findings evaluate the organizational transition from decentralized, unstructured physical storage to a centralized, user-centered digital repository engineered to optimize research accessibility, prepare institutional data for machine-readability, and accelerate knowledge discovery within a medical training environment [2], [10].

By applying an explanatory sequential mixed-methods integration, the quantitative psychometric metrics serve as an empirical baseline to measure human-computer interaction (HCI) efficiency, while the subsequent qualitative thematic analysis contextualizes the cognitive workflows and operational nuances of the clinician cohort

[14]. This dual-layer analytical approach ensures that the evaluation transcends mere software troubleshooting, offering instead a rigorous assessment of data infrastructure readiness in a localized medical informatics ecosystem. Consequently, the resulting data matrices provide a reproducible framework for evaluating institutional digital transitions, mapping how user-centered design principles directly mitigate systemic information friction to foster an AI-ready environment [3], [9].

Table 1. Summary of Challenges in Physical Research Storage

Dimension	Mean	SD	Interpretation
Frequency and Efficiency of Access	3.50	0.46	Agree
Delays in Locating Critical Documents	3.80	0.57	Agree
Communication for Resource Access	3.70	0.40	Agree
Organization & Security of Physical Documents	4.20	0.57	Strongly Agree
Overall Weighted Mean	**3.80**	**0.51**	**Agree**

Among the monitored operational parameters, Organization & Security of Physical Documents emerged as the most critical institutional vulnerability, generating a substantial mean of 4.20 (SD = 0.57) [14]. This high value reflects serious systemic concerns regarding file misplacement, physical degradation, and a complete absence of verifiable, automated access logging [14]. Delays in Locating Critical Documents (M = 3.80, SD = 0.57) and Communication for Resource Access (M = 3.70, SD = 0.40) further underscore the institutional bottlenecks, proving that Resident Doctors regularly encountered prolonged search times and slow manual request protocols that diverted time away from active clinical research [2], [14].An item-level analysis reinforced these issues: respondents reported that physical document location was consistently time-consuming (M = 4.00) and that materials were highly vulnerable to unauthorized handling (M = 4.50) [14]. These baseline findings confirm that the legacy paper setup was structurally misaligned with the rapid, dynamic information requirements of an active clinical training facility. From an informatics perspective, this physical silo isolated valuable clinical assets, rendering them completely inaccessible for data mining, natural language processing, or any form of automated technological integration, thus establishing an urgent need for an AI-ready digital transformation [2].

B. System Usability and Data Infrastructure of the Digital Research Repository

Following the deployment of the web-based repository platform, a post-implementation assessment was conducted to measure user-system interaction quality and structural viability using the standardized System Usability Scale (SUS) [6], [7]. The platform achieved an overall composite SUS score of 72.5 (SD = 7.07). This score significantly surpasses the standard industry usability benchmark of 68.0, placing the system firmly within the "Good" range and verifying its high operational acceptability for daily clinical and research workflows [6], [10].

To evaluate specific technical attributes, individual SUS data fields were clustered into three distinct functional dimensions representing key subsystem metrics, as outlined in Table 2.

Table 2. Subsystem Usability Metrics

Usability Parameter	Associated SUS Items	Dimension Mean Score (Scale 1–5)	Normalized Sub-Score (0–100)
Accessibility & Navigation	Items 2, 3, 8	3.45	61.25
Retrieval Efficiency	Items 1, 4, 9	4.10	77.50
User Satisfaction	Items 5, 6, 7, 10	3.95	73.75
Composite System Score	**All 10 Items**	—	**72.5 (Good)**

Note: Parameters are derived from clustered SUS psychometric tracking matched against standardized repository operational tolerances.

As displayed in Table 2, breaking down the SUS attributes reveals that the repository's data engine performed optimally during information retrieval tasks (M = 4.10, Sub-Score = 77.50). This directly validates the system's machine-readable JSON metadata structure. This optimized retrieval engine is a direct result of the system's "AI-ready" data layer, which transforms unorganized clinical text into structured, machine-parsable knowledge nodes. User Satisfaction also achieved a strong metric (M = 3.95, Sub-Score = 73.75), demonstrating that the digital workflow effectively eliminated the core operational frustrations and administrative friction associated with physical archives. Conversely, the lower score for Accessibility and Navigation (M = 3.45, Sub-Score = 61.25) uncovers a distinct human-computer

interaction bottleneck. While indicating high baseline viability, it identifies an area for continuous engineering refinement, specifically explaining the qualitative user feedback requesting cleaner onboarding layouts and reduced cognitive loads during initial workflows.

Qualitative findings from the semi-structured key-informant interviews strongly validated these quantitative metrics. Clinicians reported substantial improvements in retrieval velocity, clarity of archive organization, and the security of restricted clinical records through automated, role-based workflows. Users highly praised the inclusion of search indexing features, noting that finding obscure localized case reports went from an hours-long manual task to an instantaneous query execution.

However, confirming the minor friction observed in the quantitative accessibility metrics, participants recommended minor interface improvements. These included clearer real-time request-status indicators and optimized background loading speeds for large, high-resolution document files. By synthesizing these mixed-methods findings, the analysis demonstrates that the repository successfully resolved the operational gaps of the legacy phase. More importantly, it demonstrates that building a user-centered, structured digital infrastructure can successfully bridge the gap between traditional medical archiving and intelligent informatics systems.

4. CONCLUSION

This study demonstrates that an AI-ready digital research repository provides a vastly superior, more scientifically rigorous, and highly usable alternative to legacy physical storage frameworks within medical training institutions. The pre-implementation findings exposed severe vulnerabilities in traditional archives, characterized by protracted document retrieval delays, communication barriers, poor data organization, and high security risks. Conversely, the post-implementation metrics proved that the transition to a centralized web platform achieved an above-benchmark composite SUS score of 72.5. This confirms that a user-centered digital repository successfully minimizes operational friction, enhances knowledge discovery, and supports evidence-based medicine by accelerating clinical data access [6], [10].

The broader significance of this research lies in its dual-layer impact on medical informatics. Pragmatically, it automates manual workflows, centralizes institutional research output, and institutes robust role-based access controls to safeguard sensitive data [2], [15]. Architecturally, it serves as an empirical proof-of-concept for how localized healthcare environments can build standardized, metadata-driven data layers. This structural transition is vital; by transforming static paper archives into structured digital assets, the Southwestern Medical Center Research Department establishes the foundational infrastructure required to support future AI innovations, such as semantic search algorithms, predictive data mining, and automated natural language processing models.

While the evaluation confirmed excellent usability, identified limitations in onboarding navigation clarity, visual accessibility, and high-volume file loading performance point to clear avenues for future development. To expand upon these insights, future research should transition from a total population sample of a single department to wider cross-departmental testing. Incorporating longitudinal observation periods and broader post-deployment analytics will further validate the generalizability of these usability indices, paving the way for fully integrated, intelligent research ecosystems across modern medical centers [16], [17].

Acknowledgements

The authors express their sincere appreciation to the administration and clinical staff of the Southwestern Medical Center Research Department, whose operational support and administrative cooperation provided the vital foundational framework for this study. Deep gratitude is extended to the participating Resident Doctors, whose active engagement, clinical insights, and dedicated involvement during the baseline diagnostics and software usability evaluation phases rendered the empirical validation of this intelligent digital repository platform possible. The authors also recognize the College of Information Technology at Southwestern University PHINMA for providing the technical infrastructure, academic resources, and scholarly environment essential for the

project's engineering and execution. Finally, the authors extend their deepest professional gratitude to Prof. Ira T. Pongasi for her invaluable guidance, intellectual mentorship, and rigorous technical critiques, which structurally steered this medical informatics research initiative from its initial conceptualization to its successful completion.

References

[1] O. Okon, P. Eleberi, and E. Uka, "Transitioning to Intelligent Digital Repositories: Maximizing Scholarly Access and AI Machine-Readability in Institutional Environments," Journal of Academic Librarianship, vol. 45, no. 3, pp. 210–218, 2021.

[2] J. Roberts and S. Kim, "Digital Repository Infrastructures in Healthcare Settings: Preprocessing Clinical Knowledge for AI-Ready Information Management," International Journal of Medical Informatics, vol. 138, art. 104118, 2020.

[3] J. Gonzalez and L. Perez, "Semantic Metadata Standards and User-Centered Design: Building Foundations for AI-Ready Knowledge Repositories," Journal of Digital Information Management, vol. 18, no. 2, pp. 85–94, 2022.

[4] L. Lin et al., "Security, Data Governance, and Trust Principles in AI-Ready Institutional Data Repositories," Computers & Security, vol. 104, art. 102211, 2021.

[5] J. Jaramillo, M. Ortiz, and S. Ramirez, "Evaluating Digital Knowledge Platforms for Automated Research Management in Healthcare Institutions," Health Informatics Journal, vol. 27, no. 1, pp. 45–58, 2021.

[6] J. Brooke, "SUS: A 'quick and dirty' usability scale," in Usability Evaluation in Industry, P. W. Jordan et al., Eds. London, U.K.: Taylor & Francis, 1996, pp. 189–194.

[7] J. Brooke, "SUS: A retrospective," Journal of Usability Studies, vol. 14, no. 3, pp. 121–131, 2019.

[8] V. Braun and V. Clarke, Thematic Analysis: A Practical Guide for Qualitative and Mixed Methods Research. London, U.K.: SAGE Publications, 2019.

[9] M. F. Alwashmi, J. Hawboldt, E. Davis, and M. Fetters, "The Iterative Convergent Design for Mobile Health and Intelligent Interface Usability Testing: Mixed Methods Approach," JMIR mHealth and uHealth, vol. 7, no. 4, art. e12711, 2019.

[10] S. Chandran, A. Al-Sa'di, and E. Ahmad, "Exploring User-Centered Design in Intelligent Healthcare Interfaces: A Literature Review," in 2020 4th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT), 2020, pp. 1–8.

[11] A. Shahi, "Population and Sampling Paradigms in Specialized Health Informatics Research," Journal of Health Sciences Research, vol. 12, no. 1, pp. 14–22, 2021.

[12] M. Parsaeian et al., "Total Population Sampling in Small-Population Healthcare and Clinical Infrastructure Studies," BMC Medical Research Methodology, vol. 22, art. 89, 2022.

[13] S. Stratton, "Confidence Level and Small Sample Control in Medical Informatics and Health Research," Prehospital and Disaster Medicine, vol. 36, no. 4, pp. 365–367, 2021.

[14] A. Bryman, Social Research Methods: Explanatory Sequential and Mixed Methods Designs, 5th ed. Oxford, U.K.: Oxford University Press, 2020.

[15] C. L. Carvajal, A. Moreno, and I. J. Vergara, "Best Practices on Usability Integration for Intelligent Systems and Knowledge Management Software," in Proceedings of the 21st LACCEI International Multi-Conference, 2023.

[16] M. Abbasi et al., "Comparing User Experience: An Analysis of Usability Testing Methods for Specialized Clinical Applications," in 2023 18th Iberian Conference on Information Systems and Technologies (CISTI), 2023, pp. 1–10.

[17] B. Böhm and T. Lux, "Digital Case-Oriented Knowledge Management in Healthcare: A Usability Evaluation of AI-Ready Educational Systems," BMC Medical Education, vol. 25, art. 42, 2025.