



# Designing a Medical Records Student Lab Learning Application for Patient Data Management

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<p><b>Track Record Article</b></p> <p>Revised: 24 January 2026 Accepted: 21 February 2026 Published: 31 March 2026</p> <p><b>How to cite :</b> inta, N. S., Wahyuni, S., Mansyur, A. A., &amp; Wicaksono, R. A. (2026). Designing a Medical Records Student Lab Learning Application for Patient Data Management. <i>Contagion : Scientific Periodical of Public Health and Coastal Health</i>, 8(1), 171–182.</p>	<p style="text-align: center;"><b>Abstract</b></p> <p><i>Electronic medical records (EMR) are mandatory in Indonesian health facilities, yet students often lack access to systems mirroring real-world community health center (Puskesmas) workflows. This study developed SIMETRIK, a simulation-based tool designed to bridge the gap between classroom theory and clinical competency. Using a Research and Development (R&amp;D) approach, the application was built via a waterfall model incorporating needs analysis, UML-based design, and high-fidelity prototyping. Evaluation involved 15 respondents, 10 students, 4 lecturers, and 1 practitioner, who assessed the system using a 1–4 Likert scale across five dimensions: ease of use, navigation clarity, feature alignment, learning utility, and satisfaction. Results indicated that user satisfaction earned the highest mean score (<math>M = 3.33</math>), followed by the application's utility as a learning medium (<math>M = 3.00</math>). Feature alignment with public health workflows was rated at 2.67. Conversely, ease of use and navigation clarity received lower scores (2.33 and 2.13, respectively), signaling a requirement for interface refinement. Despite navigational hurdles, participants successfully executed registration and clinical documentation tasks. Feedback confirmed that SIMETRIK significantly improved students' understanding of EMR processes and aligned with professional practice requirements. These findings demonstrate that the application serves as a viable simulation platform for laboratory learning, underscores the importance of competency-focused digital tools, and establishes a foundation for future database-driven implementations in health informatics education.</i></p> <p><b>Keywords:</b> <i>SIMETRIK, Electronic Medical Records, Simulation-Based Learning, Usability Evaluation, Patient Data Management, Competency-Based Education.</i></p>
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## INTRODUCTION

Politeknik Baubau in Southeast Sulawesi offers a Diploma III in Medical Records and Health Information, committed to aligning student competencies with Permenkes No. 24 of 2022, which mandates the implementation of electronic medical records (EMRs) across all Indonesian health facilities (Kemenkes RI, 2022). Although the curriculum emphasizes mastery of health information systems (Raharjo et al., 2025), a notable pedagogical gap remains. Despite the critical role of EMRs in improving service efficiency and data accuracy (Nurvita Wikansari & Febrianta, 2024), students often struggle to navigate the EMR platforms used in Puskesmas (Community Health Centers). This highlights a disconnect between theoretical instruction and the specialized digital competencies required for effective clinical workflows.

Integrating electronic health records (EHR) into simulation-based education has been shown to enhance learners' documentation accuracy, informatics competency, and self-confidence (Kim et al., 2025). By bridging the gap between theoretical knowledge and clinical workflow, simulation fosters stronger navigation skills and more positive system attitudes (Kleib et al., 2021). Nonetheless, a pedagogical gap persists in the area of administrative health information management, as current platforms tend to emphasize clinical rather than administrative processes. The effectiveness of these educational tools is further explained through the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), both of which highlight perceived usefulness and ease of use as key determinants of digital system adoption and learner engagement (Pambudi & Widiyanto, 2025).

Competency-based health informatics education requires measurable outcomes that align simulation tools with professional standards. While structured simulation supports the transition from theory to clinical practice, empirical evidence on the effectiveness of EMR-specific tools in developing medical record students' competencies remains limited (Nabovati et al., 2022). This study responds to the absence of contextual simulation models tailored to administrative workflows in community health settings, a critical gap in vocational health education. Developed through an industry-academic collaboration with Astra Citra, this research supports Sustainable Development Goals 3, 4, and 9 by strengthening digital health capacity. Its primary aim is to design and evaluate a simulation-based EMR application using usability metrics, task performance, and self-perceived readiness, thereby establishing a stronger evidence base for informatics pedagogy.

## **METHODS**

This research employed a Research and Development (R&D) approach using the waterfall model (analysis, design, development, testing, implementation, and evaluation), an established framework for vocational instructional media (Rustandi & Darmawati, 2025). System design was carried out through UML modeling (Use Case and Activity Diagrams) and Entity Relationship Diagrams (ERD), with high-fidelity prototypes developed in Figma.

The study cohort (n=15) included 10 medical record students recruited via convenience sampling, along with 4 lecturers and 1 practitioner selected through purposive sampling. Data collection combined observation, standardized usability protocols, and semi-structured interviews. Needs analysis was conducted through inductive thematic analysis of interview data, which identified functional requirements for registration, documentation, and reporting.

In the evaluation phase, a pilot usability study assessed five dimensions ease of use, navigation clarity, feature alignment, learning utility, and satisfaction using a 1–4 Likert scale.

Quantitative data were analyzed through descriptive mean scores, while qualitative feedback underwent open coding to extract navigational and pedagogical themes. This formative assessment confirmed domain task fidelity and terminology consistency before laboratory deployment. The study protocol was reviewed and approved by the Protocol No: 112/KPT-Politeknik Baubau/II/2026.

## RESULT

SIMETRIK is a specialized simulation platform designed to facilitate patient registration and service workflows within RMIK laboratories. Developed using a systematic waterfall model, the application bridges the gap between theory and practice to enhance clinical readiness and informatics competency. Detailed design artifacts, including UML diagrams, ERDs, and interface mock-ups, are provided in the Supplementary Appendix for replicability.

### Usability Evaluation

System design for SIMETRIK began with a requirements analysis to establish a functional framework for medical record laboratory activities. A pilot usability study was conducted in which students performed standardized EMR workflows, including registration, anamnesis, and reporting. Initial needs assessments with faculty at Politeknik Baubau identified a critical pedagogical gap, as the absence of a dedicated digital skill-lab platform has historically hindered student preparation for clinical placements. SIMETRIK was therefore developed to address these shortcomings by providing a preparatory tool for community health center documentation workflows, thereby strengthening learning processes and improving student readiness for practical training. This aligns with the statement:

*“Yeah, so far we haven't had any apps in the RMIK lab to practice for our internships in health centers”*

Informant ME, 38 years

Needs assessment interviews with medical record practitioners at the Wajo Community Health Center identified Service, Admin, and Registration as critical functional requirements. These modules, mirroring the high-frequency features of the E-Puskesmas system, were integrated into SIMETRIK to ensure structural fidelity. This alignment provides students with a realistic pedagogical environment, directly enhancing their technical readiness for community health center clinical placements.

*“Usually, when students start their practice, we have to teach them how to use E-Puskesmas from scratch. So, by this SIMETRIK app, they'll already have a head start. Since, the most important features in E-Puskesmas are definitely Registration and Services.”*

Informant YO, 40 years

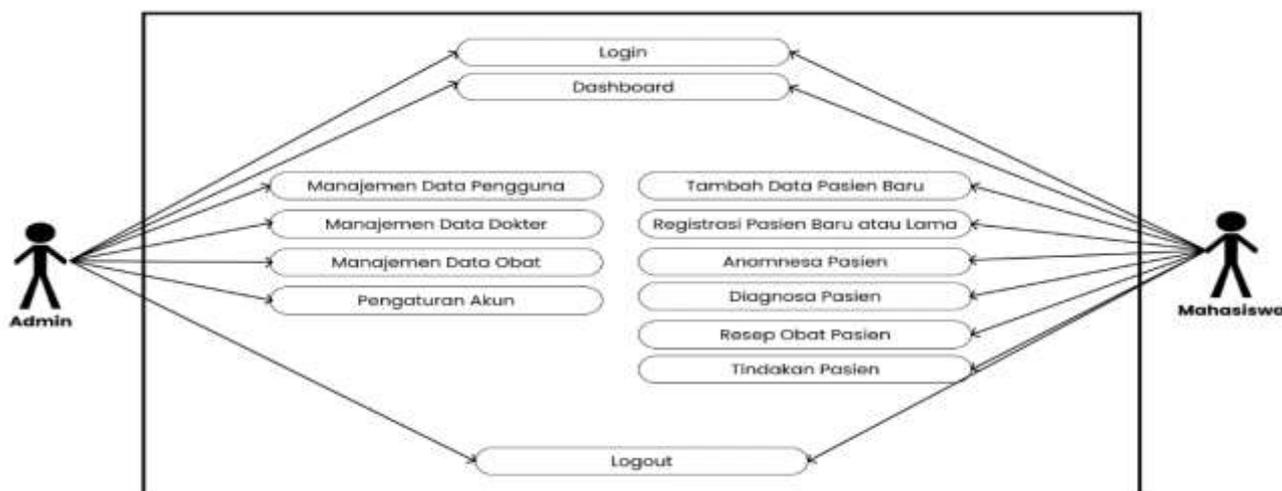
Prior to clinical placement, students typically receive initial training on the E-Puskesmas platform. SIMETRIK facilitates this transition by providing foundational knowledge through functional parity in core modules, specifically patient registration and clinical services. Evaluative interviews with fifth-semester medical record students, who had completed their field practicum, confirmed the application's pedagogical utility. Their feedback underscored the following:

*“We've never studied RME apps before. That's why during our first internship, the supervisor had to teach us everything on the first day. We felt so awkward and out of place.”*

Informant AN, 20 years

## System Design

The structural framework of SIMETRIK utilizes Unified Modeling Language (UML) to align software logic with standardized medical protocols. The system architecture is anchored by a Use Case Diagram (Figure 1), defining functional boundaries between Administrator and Student users.



**Figure 1. Use Case Diagram of the Patient Service Information System**

Administrative workflows encompass secure authentication, user role management, and the maintenance of master data for medical personnel and pharmaceuticals, ensuring that the laboratory environment remains controlled and aligned with professional standards. For students, the interface replicates the sequential stages of the *Puskesmas* service flow, guiding users through key transitions from patient admission to clinical documentation, including

anamnesis, diagnostic coding, and therapeutic interventions. By codifying these real-world requirements into the system's logical blueprint, the application ensures each digital interaction reinforces standardized medical record protocols.

The finalized prototype translates the logical models into a high-fidelity interface, beginning with a secure Login Menu and a centralized User Dashboard. Navigation is structured through a menu system that includes dedicated modules for Patient Data History and administrative settings, enabling longitudinal visit tracking and role management. While these secondary screens provide essential support, the system's primary focus remains on the core clinical modules. By replicating the functionality of professional healthcare software, the interface directly enhances students' technical fluency and prepares them for the complexities of real-world EMR systems.

The SIMETRIK database architecture, illustrated in the Entity Relationship Diagram (ERD), maintains data integrity through normalized relations between core entities: Users, Patients, and Registration (Figure 2). Clinical documentation is managed via dependent entities, Anamnesis, Diagnosis, Physical Examination, and Discharged Patients, linked by foreign keys to ensure chronological consistency and a high-fidelity simulation environment.

System logic is defined by activity diagrams mapping administrative workflows (authentication and master data management) and student-facing processes that replicate the *Puskesmas* service flow. These modeled sequences guide users through patient admission, clinical documentation, and diagnostic coding, ensuring digital interactions align with professional protocols.

The finalized prototype translates these models into a high-fidelity interface featuring a secure login, centralized dashboard, and structured navigation menus. While secondary modules support longitudinal tracking and administration, the primary focus remains on simulating integrated clinical workflows to enhance students' technical fluency.

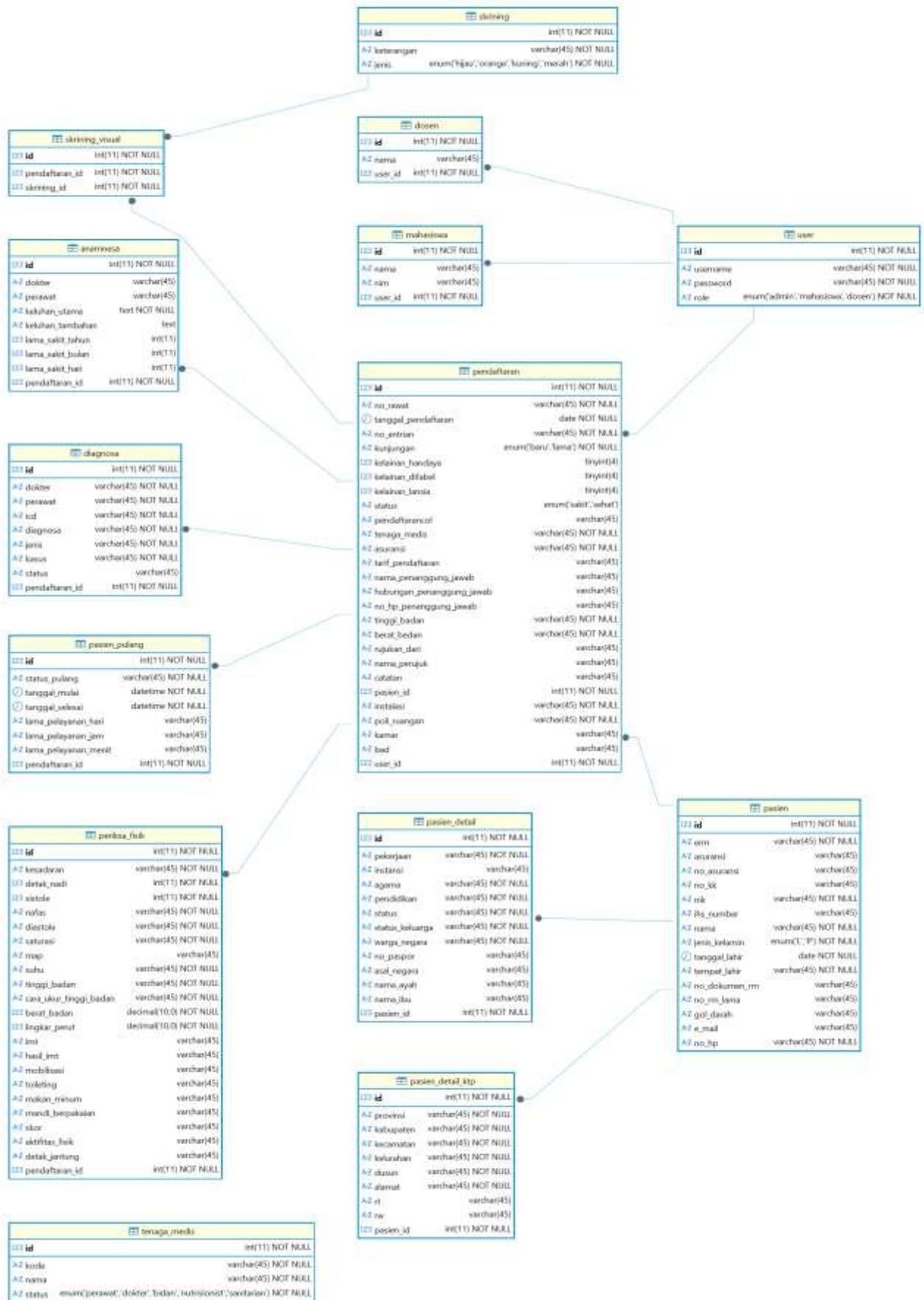


Figure 2. Activity diagram of Entity Relation Diagram (ERD)

## Implementation

The finalized SIMETRIK prototype translates these structural models into a high-fidelity interface designed for immersive documentation. Functional parity with the E-Puskesmas system is achieved through core modules for patient registration and clinical services. Clinical competency is primarily fostered through the Patient Registration (Figure 3) and Patient Medical Record (Figure 4) modules, which simulate the integrated recording of demographics, anamnesis, and diagnostics. Collectively, these interfaces serve as a functional replica of professional healthcare software, directly enhancing students' technical fluency.

Figure 3. Patient Registration

No. Rekam Medis	Nama Pasien	Jenis Kelamin	Tanggal Lahir	Rekam Medis
000001	Andi Pratomo	Laki-laki	12/01/2000	<ul style="list-style-type: none"> <li>1. Anamnesis: keluhan demam, batuk, pilek.</li> <li>2. Pemeriksaan Fisik: T<sub>aks</sub> 38,5°C, RR 20/menit, SpO<sub>2</sub> 95%.</li> <li>3. Pemeriksaan Lab: Hb 12 g/dl, Hct 35%, WBC 10.000/mm<sup>3</sup>.</li> <li>4. Tindakan: Parasetamol 500mg, istirahat, minum banyak air.</li> <li>5. Tindak Lanjut: kontrol 7 hari.</li> </ul>

Figure 4. Patient Medical Record

## System Testing and Evaluation

System validation of SIMETRIK demonstrated functional operability across all primary modules, though specific components require iterative refinement. While authentication and navigation were successful, user feedback indicated a need for enhanced interface intuitiveness and streamlined menu transitions. Report visualization effectively

retrieved registration and service data, yet lacked sufficient depth for advanced clinical informatics. Conversely, the Patient Registration and Patient Care modules exhibited high reliability, enabling seamless data entry and clinical documentation, including anamnesis, diagnosis, and physical examination, in accordance with established test scenarios (Table 1).

**Table 1. Results of the SIMETRIK System Trial**

No	Component	Test Scenario	Constraints	Description
1	Data Login	Log in to the system using a valid username and password	Simplification and improvement of login access is needed	Can be operated after briefing
2	Application Navigation	Users can easily move between menus	Navigation is not intuitive, needs simplification	Successful, but navigation needs improvement
3	Report Visualization	Displays complete service and registration reports	Visualization is not informative enough, needs development	Successful, but report visualization needs improvement
4	Patient Registration	Performing new patient registration with complete and accurate data	No obstacles	Success
5	Patient Care	Performing the patient service process according to the scenario (anamnesis, diagnosis, examination)	No obstacles	Success

User evaluation demonstrates high efficacy in pedagogical utility and user satisfaction. Satisfaction scores achieved the highest rating ( $M = 3.33$ ;  $SD = 0.49$ ), categorized as "Excellent," while the application's utility as a learning tool was rated positively ( $M = 3.00$ ;  $SD = 0.53$ ), confirming its effectiveness in facilitating contextual medical record management. Functional alignment with *Puskesmas* workflows was rated at 2.67 ( $SD = 0.49$ ), meeting core simulation requirements. Conversely, ease of use and navigation clarity received lower scores (2.33 and 2.13, respectively), falling within the "Poor" category. These results indicate that while the system offers significant instructional value, substantial interface optimization is required to mitigate operational obstacles and enhance the user experience (Table 2).

**Table 2. Evaluation Results of the SIMETRIK Application**

Assessment Domain	Mean	Standard Deviation (SD)
Ease of application use	2.33	0.49
Navigation menu clarity	2.13	0.52
Feature alignment with public health service workflows	2.67	0.49
Application utility as a learning medium	3.00	0.53
User satisfaction	3.33	0.49

## DISCUSSION

The SIMETRIK prototype addresses a critical pedagogical gap in Medical Record (RMIK) education by facilitating the transition from theoretical instruction to high-stakes clinical placement. While platforms like E-Puskesmas are essential for field practice, their inherent complexity often presents a steep learning curve that impedes student performance and self-efficacy.

The evaluation identifies SIMETRIK as an effective pedagogical bridge, enabling students to develop proficiency in registration and anamnesis workflows with minimal intervention. By aligning the interface with learners' mental models, the application emphasizes the logical sequence of medical documentation rather than the mechanics of software operation. Unlike manual exercises, SIMETRIK's digital flow enforces data integrity through "forced logic," requiring completion of registration before diagnostic input. This structural constraint reduces cognitive load during clinical practice by internalizing systemic EHR requirements. These findings reinforce the claim that simulation-based training enhances clinical readiness (Mollart et al., 2021), while specifically demonstrating that for RMIK students, the primary educational value lies in the explicit visualization of the patient data lifecycle.

SIMETRIK's structural efficacy is derived from rigorous system modeling, including Use Case, Activity, and Entity Relationship Diagrams, which define the interactions between administrators and students. This approach aligns with Ardhana (2021) and Chen (2018), who posit that precise UML modeling clarifies user requirements and minimizes implementation errors. While Rangga et al., (2021), identified the absence of information system simulations as a barrier to clinical readiness, SIMETRIK provides a concrete UI/UX-focused intervention. Furthermore, whereas Lee et al., (2024) emphasize general EHR simulation utility, this study identifies "simplicity" and intuitive interfaces (Azis, 2019) as critical attributes for novice learners. Departing from the complex architectures discussed by Kamalpreet Kaur and Monika Khandelwal (2019), SIMETRIK's success suggests that for pedagogical purposes, functional fidelity and user experience provide greater instructional value than structural backend complexity.

The utilization of Figma as a development platform facilitated real-time visualization and iterative refinement of medical service and registration modules, corroborating (Moreira et al., 2024), regarding the efficiency of collaborative design tools in producing user-centric interfaces. This study advocates for "scaffolded digitalization" within health informatics curricula, utilizing high-fidelity prototyping to iterate on instructional design while circumventing the resource-intensive costs of full software development. This methodology

aligns with "fidelity-on-demand" theory, wherein simulation complexity scales with student competence. Furthermore, as noted by Silva et al. (2024), the pedagogical efficacy of these instruments is rooted in user experience, suggesting that medical records education should integrate UI/UX literacy as a core competency for future health information managers.

System evaluation and maintenance identified that while core workflows were successful, enhancements in navigation and report visualization remain necessary. This iterative refinement aligns with Shafiq et al., (2021), who emphasize early error detection through rigorous testing, and Soraya & Marzuki (2024), who posit that the efficacy of health learning applications depends on continuous systemic adjustments. Furthermore, the requirement for periodic updates to accommodate technological shifts is supported by Nguyen et al., (2017) and Alqahtani & Orji (2020), who correlate regular system maintenance with sustained user satisfaction and relevance.

### **Limitations**

The SIMETRIK prototype is currently constrained by its Figma-based framework, which lacks a deployed database to simulate technical stressors such as system latency or data concurrency. The evaluative scope was limited to a small, localized cohort, potentially introducing a "novelty effect" rather than proving long-term pedagogical efficacy. Additionally, the absence of a control group or longitudinal tracking precludes quantitative comparisons with traditional paper-based methods regarding clinical performance.

### **Future work**

Future research will transition the prototype to a functional web-based deployment with a robust SQL database to simulate real-world data management challenges. A quasi-experimental, multi-center longitudinal study will be conducted to rigorously measure impacts on documentation accuracy and task completion time. Furthermore, expanding the system to include automated data visualization and interoperability testing will align the tool with modern health information standards.

### **CONCLUSION**

The development of the SIMETRIK prototype effectively bridges the gap between theoretical instruction and clinical practice in medical records management. Evaluation results confirm high usability and successful simulation of the E-Puskesmas functional workflow, enabling students to master the sequential logic of patient data management. Theoretically, these findings validate the role of high-fidelity simulations in managing cognitive load, allowing novice learners to prioritize documentation accuracy over software mechanics.

Practically, the study demonstrates that digital scaffolding within a laboratory environment is a viable strategy for strengthening student confidence ahead of high-stakes clinical placements. Beyond usability, the prototype's primary contribution lies in establishing a scalable model for integrating UI/UX literacy and functional fidelity into vocational health informatics curricula.

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