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Development of a Web-Based Educational Information System Using the RAD Method: A Case Study at Persahabatan Hospital

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Abstract: RSUP Persahabatan operates as a teaching hospital supporting clinical education for medical professionals through Specialist Medical Education Programs (PPDS) and medical internships (Coass). The current registration infrastructure exhibits significant operational deficiencies, including recurring data entry errors, compromised information integrity, and dependence on manual reporting via Microsoft Excel. These limitations create administrative bottlenecks and reduce process reliability. To address these challenges, we developed a web-based student registration platform employing the Rapid Application Development (RAD) methodology. RAD facilitates accelerated development cycles through iterative prototyping and continuous stakeholder engagement. The platform incorporates automated document validation mechanisms and WhatsApp notification systems triggered upon registration approval. Implementation involved four RAD phases: planning, user design, construction, and cutover. Black-box testing and user acceptance testing validated functional integrity across all modules. Testing results demonstrated zero errors in registration workflows, document uploads, and verification processes. The platform achieved a maximum response time of 2.8 seconds per transaction while supporting concurrent user access. Results indicate measurable improvements in administrative efficiency, data accuracy, and processing speed compared to the previous manual system.

Keywords: Information System; RAD; Student Registration; RSUP Persahabatan; Web; WhatsApp.

1. Introduction

RSUP Persahabatan located in East Jakarta is a class A referral hospital that has been designated as the national center for respiratory disease and also operates as a teaching hospital. It facilitates medical education by offering the Specialist Medical Education Program (PPDS) and clinical internships for general practitioners (Coass). One of its main administrative functions is managing registration of students and interns. At present, staff members are using traditional tools mostly Microsoft Excel with manual verification through email or WhatsApp messaging. These manual processes create recurring operational problems like data entry mistakes, record-keeping discrepancies, slow verification cycles, and challenges in generating accurate reports for institutional evaluation. The disadvantages go beyond mere inconvenience; data duplication happens when

several administrators update spreadsheets separately without real-time synchronization. Document verification takes much time since administrators will have to cross reference submitted documents with institutional requirements manually. Participants do not know the status of their application and keep asking questions that burden administrative staff with more work. These inefficiencies prompted the creation of an integrated web-based platform that could automate routine tasks while preserving data integrity and enhancing user experience for all parties involved.

Web-based information systems have been practical solutions for educational administration in several institutions. The RAD (Rapid Application Development) methodology is very applicable in educational environments where time pressure and changing user requirements are involved, thus necessitating a flexible approach to development. RAD is based on iterative prototyping, constant feedback, and accelerated delivery cycles; therefore, it is suitable for organizations that need fast digital transformation without long development times. Yudahana, Riadi, and Elvina discussed the design of a web-based new student admission information system as an example of how RAD methodology could help streamline registration workflows and reduce the manual workload of administrative personnel [1]. This paper gave some basic principles about applying RAD in education registration particularly concerning user interface design and database architecture. It also found that one effect of RAD's iterative nature is that it enables developers to quickly adapt to changing institutional requirements, which can be very useful in dynamic educational environments. Mulyati *et al*. used RAD to develop a school information system at Yayasan Al Abaniyah where the previous registration process was heavily dependent on paper forms and manual promotion through WhatsApp [2]. Their web-based platform improved administrative efficiency significantly even under constrained development timelines as well as promotional effectiveness. This research proved that institutions with limited technical infrastructure could make a successful jump into digital systems by using the right development methodology. Findings from this study also revealed that administrative processing time decreased by about 60% after the system was implemented and there was measurable improvement in data accuracy.

Prabowo and Suprapto used RAD to build a decision-support system based on Profile Matching into the online admission system of SMK Ma'arif NU 2 Boyolali [3]. The school had been using a digital registration system, but their work improved objectivity and automation in selecting candidates. The study showed that RAD could be used to make gradual improvements to existing digital systems rather than needing entire system redesigns. Their decision-support system lowered subjective bias in admission decisions while keeping clear transparency about evaluation criteria. Aini, Wicaksono, and Arwani were focused on building a web-based library information system at SMK Negeri 11 Malang with RAD [4]. Their application replaced the manual logbook for lending and cataloging with an electronic one, thus improving user experience as well as administrative tasks. Black-box testing resulted in 100% validity for functional requirements; meanwhile, user acceptance testing was rated at 84% satisfied users. This research also highlighted how important it is to design something with users in mind during the prototyping phase since early involvement of stakeholders has proven to correlate directly with higher rates of acceptance when deployed. Zulfallah and Hidayatuloh applied RAD in creating an internship registration system for the Inspectorate General of the Ministry of Education and Culture (ITJEN Kemendikbud) [5]. This system solved perennial problems such as lost documents and inefficient processing workflows that existed within the previous paper-based system [6]. The study illustrated that RAD could be employed to fix particular operational pain points through specific feature development, especially concerning document tracking and status notification systems.

Santoso and Amanullah developed a web-based academic information system for SMA YATPI, migrating from isolated computer storage to a centralized system. They proved RAD could support digital transformation at the institutional level by segmenting large projects into smaller development sprints. The study established that centralized data management minimized redundancy and increased accuracy in reporting for institutional decision-making. Further, Arinal and Ikawati (2021) utilized the RAD methodology to create an inventory management system at PT. Agree Progress International located in West Jakarta, which proves that this methodology is not limited to educational settings only but can be applied to other sectors as well [7]. Their research revealed how principles of RAD could be tailored according to different organizational needs without compromising on speed of delivery. Collectively these studies validate the RAD as effective under conditions of time constraints for development while still meeting user-specific requirements. However, most previous studies have been conducted on student admission or academic management systems with very few focusing on specialized medical education registration platforms. The unique needs of RSUP Persahabatan such as multi-level verification workflows, integration with messaging platforms for real-time notifications, and adherence to medical education standards require a specialized solution. This research therefore fills that gap by developing a registration platform specifically meant for teaching hospital environments where administrative accuracy has direct implications on clinical education quality and regulatory compliance.

2. Related Work

Educational institutions have adopted web-based registration systems to streamline administrative tasks and eliminate inefficiencies associated with manual paperwork. Electronic forms have replaced paper forms, with each system tailored to solve specific operational problems within its context. Research in diverse areas can provide insights into system architecture, user interface design, workflow automation, and stakeholder management, which are relevant for developing registration systems in specialized settings like teaching hospitals. Schools and universities have implemented web-based registration as part of their admission processes. Prospective students can submit applications online, upload required documents, and check the status without the need to visit campus offices. Automated validation checks for missing information and notifies applicants, thereby reducing the workload on administrative staff [8]. Studies indicate that both applicants and administrators are satisfied with the transition from paper-based processes to electronic systems [8]. Universities with complex admission criteria have developed platforms that incorporate decision-support tools for ranking candidates based on academic records, test scores, and extracurricular activities [9]. Algorithm-based ranking ensures fairness while making the evaluation criteria transparent [8]. For schools that handle thousands of applications, automated scoring eliminates the time burden associated with manual evaluation [9]. Libraries have transitioned from physical logbooks to automated systems for managing library collections. Paper-based systems made it difficult to track lending, returns, and inventory accurately. Modern library management systems allow users to search catalogs, reserve items, and receive reminders for due dates. These features improve service quality and operational workflow [10]. Similar digital solutions have been developed for internship and practicum programs that require coordination between students and host organizations. These platforms handle application processing, document tracking, and submission of agreements and evaluation forms [10]. Paper-based systems often resulted in lost paperwork and confusion about the status of applications, frustrating all parties involved. Digital platforms address these issues through centralized storage, automatic status updates, and activity logs that track every action taken on a record [11].

Rapid application development has been widely used for the development of registration systems. Early prototypes are built and then iteratively refined in several cycles based on user feedback [12]. Engaging stakeholders from the beginning helps ensure the system is designed to meet real needs rather than perceived ones, reducing the time to deployment and increasing satisfaction [13]. Rapid application development also allows for adjustments to be made in response to changing policies or user feedback without impacting the overall timeline. Organizations that utilize iterative development report faster implementation times and greater user buy-in compared to those that follow traditional, sequential methodologies [12][13]. This approach provides the flexibility needed for developers to adjust to changing institutional policies and user needs while still maintaining momentum in the project.

Registration systems are prevalent in educational settings, yet there exists a dearth of purpose-built registration systems tailored for use within medical training environments. Teaching hospitals face unique challenges that differentiate them from standard educational institutions. Medical education programs operate within highly regulated frameworks concerning accreditation, supervision, and competency documentation [14]. Registration processes must include safeguards to ensure compliance with licensing and credentialing requirements [15]. Although some research has been conducted into general principles for developing educational registration systems [8], there remains an unmet need for registration systems designed specifically for teaching hospitals that can address regulatory compliance, clinical rotation scheduling, and professional credentialing—tasks that go beyond the scope of traditional student admissions systems.

3. Research Method

This study adopts the Rapid Application Development (RAD) methodology, emphasizing fast development cycles, continuous user feedback, and iterative prototyping. The research process includes the following key phases:

3.1 Research Data

The data used in this study is private and was obtained directly from the Educational Coordination Committee at RSUP Persahabatan. It includes administrative information on Specialist Medical Education Program (PPDS) and medical internship (Coass) students, such as personal identity, originating institutions, education periods, and registration histories. These data are classified and not publicly available.

3.2 RAD Phases

3.2.1 Planning Phase

Literature review and observation of existing registration processes revealed inefficiencies in manual workflows using printed forms and spreadsheets. Interviews with the educational committee identified feature needs such as notification systems, real-time verification, and reporting capabilities. Core features were outlined, including registration, verification, data management, reporting, access control, and security. Functional and non-functional requirements were compiled into structured specifications.

Table 1. Functional and Non-Functional Requirements

No	Functional	Non-Functional
1	The system can process student registration online.	The system is web-based and accessible through modern browsers.
2	The system supports login functionality for participants, hospital admins, and program admins.	The system must have secure login mechanisms (at minimum, password hashing).
3	The system allows participant data to be verified by hospital admins.	The system must be able to handle at least 50 concurrent users.
4	The system can display verification status to participants.	The system must have a maximum response time of 3 seconds per transaction.
5	The system can generate participant reports based on a specific period.	The system must be available at least 99% during working hours.
6	The system can manage user data and access rights.	Data backups must be performed automatically on a daily basis.

3.2.2 User Design Phase

UI mockups were developed and refined based on stakeholder feedback through iterative discussions and revisions to ensure usability and alignment with user workflows. ERD and Use Case diagrams were created to clarify entity relationships and actor responsibilities in the system.

Figure 1. Prototyping.

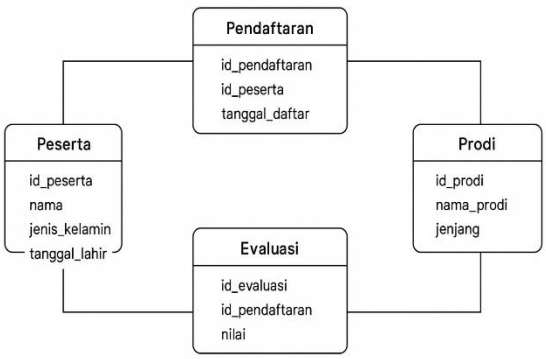

Figure 2. ERD.

3.2.3 Construction Phase

The system was built using CodeIgniter (PHP framework), MySQL database, Bootstrap for front-end design, and XAMPP with phpMyAdmin for development environment. Key functions implemented include input validation, file upload handling, report generation, access control, and session security.

Table 2. Technology Stack and Implementation

No	Component	Description
1	Programming Language	PHP (using CodeIgniter framework)
2	Database	MySQL
3	Supporting Tools	VS Code, XAMPP, phpMyAdmin
4	Form Validation	if ($this->form_validation->run() == FALSE) { ... }
5	Duplicate NIK/Email Check	SELECT COUNT(*) FROM peserta_didik WHERE nik = '$nim' OR email = '$email'
6	Document Upload	$this->upload->do_upload('file_ijazah');
7	Registration Report	SELECT peserta.nama, status_verifikasi, tanggal_daftar FROM peserta_didik JOIN verifikasi ON ...
8	Output	Information system ready to use (beta version)

3.2.4 Cutover Phase

Black-box and User Acceptance Testing (UAT) validated functional integrity before deployment. The final version was hosted on a secure internal server for operational use.

3.3 System Modeling

Supporting diagrams were developed to document system architecture and workflows:

Use Case Diagram captures user-system interaction across three main actors: Peserta Didik (Student) who accesses the system, completes registration, and monitors verification status; Admin Prodi (Program Admin) who verifies documents and manages departmental data; and Admin RS (Hospital Admin) who performs final validation and approval.

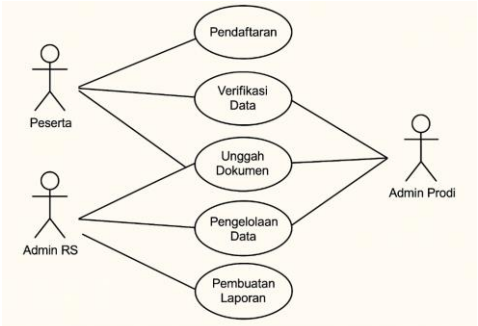

Figure 3. Use Case Diagram.

Activity Diagram describes the registration and verification workflow. Students access the registration page, fill out forms, upload documents, and submit for verification. Program admins review submissions and either approve or reject based on criteria. Hospital admins perform final validation and the system sends notifications to participants about their status.

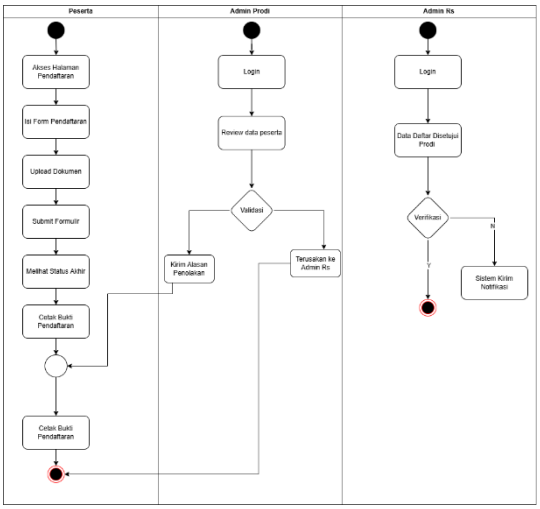

Figure 4. Activity Diagram.

Sequence Diagram depicts sequential interactions among system components. Students interact with the interface to submit registration data, which the system validates and stores in the database. Program admins access verification menus to review submissions, while hospital admins perform final checks. The system records decisions and updates participant status accordingly.

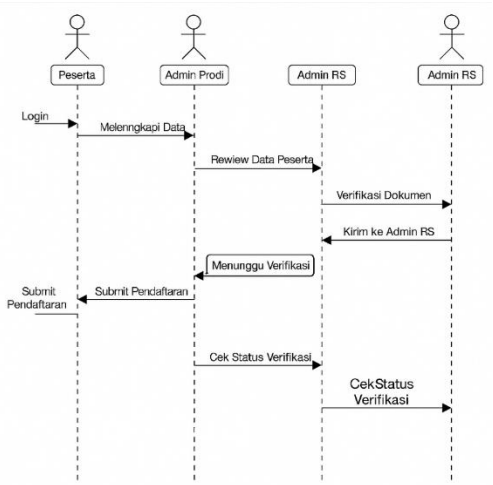

Figure 5. Sequence Diagram.

Class Diagram documents the logical database structure and relationships between entities in the system.

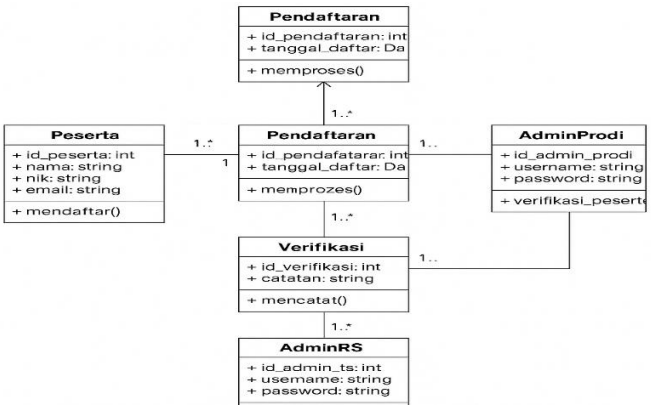

Figure 6. Class Diagram.

4. Result and Discussion

4.1 Results

4.1.1 Web-Based Student Registration Information System

The main result of this research is a web-based student registration information system for PPDS and Coass participants that can be accessed by three user roles: Students, who can perform registration, document upload, and monitor verification status; Program Admin, who verifies completeness and validity of participant data; and Hospital Admin, who manages all data, prints reports, and evaluates institutional-level data efficiently. The system includes several key features: online registration form with data validation, document upload capability (diploma, assignment letter, ID card, photo), admin dashboard for data management and verification, exportable registration reports, and registration status notifications.

4.1.2. Application of RAD Method

The implementation of the Rapid Application Development (RAD) method enabled system prototypes to be rapidly evaluated by users, allowing revisions to be made quickly and adaptively. This approach resulted in shorter and more efficient development cycles compared to traditional methodologies.

4.1.3. System Implementation and Testing

System deployment included local/server installation, database configuration, user role setup, and internal browser testing to ensure accessibility and functionality across different environments. Two testing

approaches were employed: Black Box Testing, which validates system behavior without inspecting source code, and User Acceptance Testing (UAT), where feedback from end users (students and admins) guided system refinement. All main features functioned correctly with no errors found in registration, document upload, and verification processes. The admin dashboard proved real-time and responsive, reports were successfully exportable to PDF/Excel formats, and automatic notifications were sent to users as expected. Based on UAT feedback, several enhancements were implemented including confirmation messages on document upload, enhanced form layout for mobile devices, and clearer notification messages to improve user experience. The system runs on XAMPP environment with interfaces including login pages, dashboards, user management modules, submission forms, and validation views. The database structure follows the Entity-Relationship Diagram designed during the user design phase.

Table 3. Algorithm Testing Results

No	Algorithm Name	Purpose	Expected Result	Status
1	Document Completeness Validation	Marks documents as valid if all uploaded	Document status = "Valid"	Passed
2	WhatsApp Notification on Approval	Sends automated message on acceptance	WA message sent to participant	Passed
3	Education Duration Calculation	Auto-calculate start and end dates	Duration displayed correctly	Passed
4	Unique Email & Phone Check	Prevent duplicate entries	Duplicate entries rejected	Passed

Table 4. Application Testing Results

No	Test Case	Purpose	Expected Result	Status
1	Admin Login	Login with valid credentials	Access admin dashboard	Passed
2	Add Participant	Complete form and save	Data appears in list	Passed
3	Document Validation	Click 'Valid' on each document	Status updates to Valid	Passed
4	Approval Button	Click 'Approve'	Status updated + WA sent	Passed
5	Export Report	Export participant data	File .pdf/.xlsx downloaded	Passed
6	Edit Participant	Edit and save data	Updated in participant list	Passed

4.2 Discussion

The use of the Rapid Application Development methodology in creating this registration information system has proven to be very helpful in speeding up development while keeping the system's quality. This is similar to what Yudahana *et al*. (2023) showed, where RAD makes system development faster through iterative prototyping and continuous user involvement [1]. The rapid prototyping approach allowed stakeholders to see how well the system worked early in the development cycle, enabling quick changes based on real user needs instead of just assumptions. Mulyati *et al*. (2024) confirmed that RAD significantly reduces development time while making sure that the final product meets user requirements through active stakeholder participation during each development phase [2]. The iterative nature of RAD made adaptive revisions possible throughout the development process, which was especially useful in an educational administrative environment where requirements could change based on institutional policies. Santoso and Amanullah (2022) pointed out that RAD's flexibility allows developers to accommodate changing requirements without disrupting the overall development timeline; this characteristic became very important when UAT feedback required improvements to the interface and additional notification features [6].

The web-based registration system has brought about a drastic change in efficiency and effectiveness of student registration at RSUP Persahabatan. Moving from manual, paper-based registration to a digital platform has lessened input errors and data duplication which are usually found in traditional systems. Nurhayati *et al*. (2022) stated that web-based registration systems minimize human error by validating automatically and using structured data entry forms [12]. This system can provide real-time verification status with automated notifications that will enhance transparency as well as communication between participants and administrators. Wijaya *et al*. (2023) said online registration systems improve user satisfaction because they provide immediate feedback reducing uncertainty during the application process; therefore, it is very important for medical education programs where timely registration and verification are critical for program commencement since this capability represents a substantial operational improvement. The structured digital data storage enabled more accurate and efficient report generation compared to manual compilation from paper forms. Aini *et al*. (2019) showed that web-based information systems facilitate better management of data as well as reporting capabilities allowing administrators to generate reports with minimal effort [4]. Such capability is particularly valuable for institutional evaluation and compliance documentation in medical education settings wherein accurate record-keeping becomes essential for accreditation purposes.

The use of a two-tier verification process involving Program Admin and Hospital Admin, as proposed, reflects the complexity inherent in medical education registration requirements. This hierarchical verification approach ensures that data is checked for accuracy and completeness at several points, thereby minimizing the chances of incomplete or invalid registrations from moving further in the system. Paneque *et al.* (2017) stressed that registration processes need to be systematic when it comes to healthcare education; credential verification and documentation standards should be kept rigorously high for quality assurance of programs as well as compliance with regulations. The role-based access control that has been implemented in this system ensures that every type of user has just about the right permissions corresponding to their responsibilities, thus safeguarding sensitive information regarding participants while allowing smooth management of workflow. Hidayat Zulfallah and Hidayatuloh (2021) remarked that proper user role management in registration systems prevents unauthorized access and keeps data integrity, which is very important when dealing with personal and educational credentials [5]. The system's responsive design and mobile-friendly interface refined through UAT feedback reflect how much user-centered design matters in developing information systems. Prabowo and Suprapto (2019) noted that easy-to-use interfaces greatly influence the rate at which users adopt systems, especially those who are not very technically inclined [3]. Enhancements based on UAT feedback confirmation messages improved layout on mobile devices as well as clearer notifications show the importance RAD methodology places on involving end users all through development. A document upload feature with validation mechanisms would meet an essential requirement in medical educational registration whereby supporting documents need to be verified for authenticity and completeness so that user experience can be improved together with reducing administrative burden related to incomplete submissions.

The architecture based on the web and design by modules provide a base for improvement in the future and growth. The tests showed that many users could be handled at the same time and good performance meaning that the system can support institutional growth and higher registration numbers. According to Veri Arinal and Anisa Puji Ikawati (2021), systems based on the web developed with RAD methodology can easily add new features so this method is practical for long-term development of institutional information systems as needs change over time [7]. Automated WhatsApp notifications are innovative in participant communication since they use popular messaging applications to ensure timely receipt of information. This feature solves the problem of needing instant communication during registration processes where timing is crucial, especially in medical education programs with fixed start dates that require coordination among many parties; while it fulfills all the functional and non-functional requirements identified, there are still some aspects that can be improved in future versions. Future versions could add new features, such as document version control, advanced analytics for registration trends, and integration with other institutional systems like learning management platforms or hospital information systems. The system depends on internet connectivity which may create problems in areas with limited network infrastructure; therefore implementing offline capabilities or progressive web application features could improve accessibility and user experience across different connectivity environments.

5. Conclusion

The RAD methodology was successfully used in this study to design and build a web-based student registration system at RSUP Persahabatan. This has proved that iterative development with continuous stakeholder involvement can be an effective solution for medical education administration. The new system improved operational efficiency by changing from manual, paper-based processes into a digital platform that automates data validation, verification workflows, and communication with participants. The role-based access control and two-tier verification process involving Program Admin and Hospital Admin ensured data accuracy and security while maintaining appropriate workflow management requirements in medical education registration. Improvements in user experience were achieved through responsive interface design, mobile-friendly layouts, and automated WhatsApp notifications providing real-time updates on registration status. The system effectively reduces administrative errors by structured data entry forms, automated validation mechanisms as well as digital document management against common challenges of traditional registration methods. Testing has confirmed that the system meets both functional and non-functional requirements with successful handling concurrent users and responsive performance across different devices and browsers.

Future development may include analytical dashboards to track registration trends that generate insights for institutional planning; system logs for audit purposes to enhance accountability and compliance documentation; multilingual support for diverse participant backgrounds. Modular architecture gives flexibility in extending functionality as organizational needs evolve such as potential integration with learning management platforms or hospital information systems creating a more interconnected educational technology ecosystem. Broader adoption across other hospital units or teaching institutions affiliated could be explored maximizing the return on the investment of development and standardizing registration processes across the

medical education network. Further enhancements like document version control, offline capabilities for areas with limited connectivity, and advanced reporting features will make the system more useful and accessible. The successful implementation of the system at RSUP Persahabatan is a replicable model for other healthcare education institutions that want to modernize their administrative processes using web-based information systems developed through agile methodologies.

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