Jurnal Sistem Komputer dan Informatika (JSON)
Volume 7, Nomor 1, September 2025
e-ISSN 2685-998X
DOI : 10.30865/json.v7i1.9070

Web-Based Academic Information and Monitoring System at Kudus State Madrasah Ibtidaiyah

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Submitted: **06/09/2025**; Accepted: **28/09/2025**; Published: **30/09/2025**

Abstract− This research contributes to the digital transformation of elementary education by developing a web-based academic information and monitoring system specifically tailored for Madrasah Ibtidaiyah Negeri Kudus. The novelty of this study lies in the integration of academic data management with automated WhatsApp notifications, enabling real-time communication between schools, teachers, parents, and students. The system was developed using the Waterfall software development model, which consists of needs analysis, design, implementation, testing, and maintenance. Data were collected through interviews with school administrators and direct observations of academic activities to ensure that the system requirements reflect real user needs. The results show that the system successfully supports comprehensive academic management, including grade recording, attendance tracking, extracurricular activity documentation, and report card generation. All features passed black box testing, confirming that the system performs as expected across different user roles (admin, teacher, homeroom teacher, and student). The main result is that the system significantly improves the efficiency, accuracy, and transparency of academic data processing. The benefits of this research are twofold: first, it reduces the administrative burden on teachers and staff, allowing them to focus more on learning quality; second, it strengthens school–parent communication by providing instant access to academic information. This system represents a practical step toward digitalizing madrasah administration and opens opportunities for further innovation in technology-based education management.

Keywords: academic information system; student monitoring; attendance recording; WhatsApp-based notifications; web-based basic education

1. INTRODUCTION

Madrasah Ibtidaiyah Negeri (MIN) Kudus, as one of the basic education institutions in Indonesia, plays a central role in shaping the character and foundational knowledge of students. However, in practice, this institution still faces major challenges in academic data management. Academic activities such as recording grades, monitoring student attendance, and communicating with parents are still handled in a manual or semi-digital manner. This condition often leads to inefficiencies, including delays in reporting grades, inaccuracies in attendance records, limited access to academic information, and weak communication between schools and parents. Teachers and school staff spend a significant amount of time completing administrative tasks, which reduces the time available for improving the quality of learning[1]. In addition, there is no structured mechanism to monitor the holistic development of students in terms of academic achievement, extracurricular activities, and character building[2]. These problems show the urgent need for a more integrated and technology-driven solution[3].

In the era of digital transformation, technology offers an effective way to overcome the limitations of conventional systems. The development of web-based academic information systems has been proven to support the efficiency and accuracy of data processing in educational environments[4]. Through a web-based platform, schools can centralize various processes such as student and teacher data management, lesson scheduling, grade input, attendance tracking, and report card processing. Teachers can enter data more systematically, while parents gain easier access to their child's academic progress without having to wait for periodic meetings[5]. Importantly, the integration of communication features—especially automatic notifications via WhatsApp—offers significant added value. WhatsApp is widely used in Indonesian society and allows schools to send direct, real-time information to parents[6]. This function ensures that parents are constantly updated about important matters, such as student absences, announcements, or academic achievements[7]. This study aims to design and develop a web-based academic information and monitoring system at MIN Kudus. The novelty of this research lies in the integration of academic management features with automated WhatsApp notifications[8]. While previous studies have developed web-based academic systems, few have combined them with instant messaging platforms to ensure transparency and continuity of communication between schools and parents[6]. The urgency of this research is reinforced by the increasing demand for digital transformation in education, particularly in the aftermath of the COVID-19 pandemic, which has accelerated the adoption of digital learning tools and systems worldwide[9].

The methodology used in this research is the Waterfall model, a structured software development approach that consists of several stages: requirements analysis, design, implementation, testing, and maintenance. Data were collected through direct observation of school processes and interviews with administrative staff to ensure that the system design truly reflects the needs and expectations of its users[10]. The research findings demonstrate that the developed system is capable of supporting comprehensive academic management, streamlining administrative tasks, and enhancing the quality of communication between schools, teachers, students, and parents[11]. In summary, this research contributes significantly to the modernization of academic management at the elementary

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school level. It not only offers a technical solution for data processing but also addresses the broader need for real-time communication and transparency in education[12]. By integrating web-based academic management with WhatsApp notifications, this study provides a unique model that can be adopted by other educational institutions facing similar challenges. The outcomes of this research are expected to encourage further innovation in technology-based education management and support the government's digital transformation agenda in the education sector[13].

2. RESEARCH METHODOLOGY

To obtain accurate and relevant information during this research, the researcher used the following data collection methods:

2.1 Data Collection Methods

The data collection methods in this study are grouped into two categories, namely primary data and secondary data. Primary data is obtained directly from primary sources through methods such as observation and interviews. This type of data is important because it captures the authentic needs and perspectives of the users of the[13] system. Meanwhile, secondary data comes from official documentation such as grade archives, school academic documents, and relevant scientific literature or previous studies. This secondary data serves as a complement and comparison to ensure the validity and richness of the analysis[14].

2.1.1 Primary Data

Primary data is data obtained from the author's independent search using several data collection techniques. In this case, two types of data search methods were used, namely:

2.1.1.1 Interview

Conducted with the Kudus State Islamic Elementary School, specifically the administrative staff or school operators who handle academic data. The purpose was to identify system requirements, problems encountered in academic data management, and expectations for the information system to be developed.

2.1.1.2 Observation

The data collection method using observation or direct observation was carried out to add data sources from a different perspective. In this case, the observation was carried out on job seekers. Direct observation in the field was conducted to see how the academic management process was carried out at the Kudus State Elementary Madrasah, including the recording of student, teacher, and grade data, as well as the lesson schedule. This observation was conducted to understand the workflow, obstacles, and potential efficiencies that could be improved through a web-based information system.

2.1.2 Secondary Data

Secondary data was obtained from existing sources, such as literature, scientific journals, reference books, institutional documents, and archives related to academic information systems and web-based information system development. This data was used to strengthen the theoretical basis and support the system requirements analysis.

2.2 System Development Method

In developing the Web-Based Academic Information System at Madrasah Ibtidaiyah Negeri Kudus, the Waterfall method was used as a structured approach in the software development process. This is part of the SDLC (System Development Life Cycle) approach model. The Waterfall method has several main stages that describe the activities of system development, consisting of the following five stages[15]. The Waterfall method was chosen because the research needed a clear and step-by-step method, where each part follows the one before it in a logical way. This model helps with writing clear documents, doing testing in a planned way, and works well for projects that have clear goals, like academic information systems. The method had five main steps:

2.2.1 Requirements Analysis

At this stage, data were collected through direct observation of academic processes at Madrasah Ibtidaiyah Negeri Kudus and interviews with administrative staff, teachers, and homeroom teachers. The purpose was to identify specific user needs, including grade recording, attendance management, extracurricular documentation, and parent notification requirements. These data formed the foundation for system specifications.

2.2.2 System Design

The information gathered was translated into system architecture, database design, and interface prototypes. The design ensured alignment with user needs while preparing for the integration of WhatsApp notifications. This stage emphasized how data structures (students, teachers, subjects, attendance) would support functional modules in the system.

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2.2.3 Implementation
The system was developed using web-based technologies. Each functional module (data management, grade entry, attendance, extracurricular records, report generation, and WhatsApp notifications) was coded in accordance with the system design.

2.2.4 Testing
A black-box testing approach was applied to evaluate each feature against its functional requirements. The testing ensured that data entered by teachers or administrators produced accurate outputs, such as real-time reports and automated notifications to parents.

2.2.5 Maintenance
Feedback from users (administrators, teachers, and parents) was gathered to make necessary adjustments. This stage ensures the system remains adaptable to future academic or administrative changes.

By using real data gathered from actual use and following the clear steps of the Waterfall model, the method made sure the system solved real issues in managing academic work. Including the needs provided by users at every step of building the system made it more useful, dependable, and easy to use.

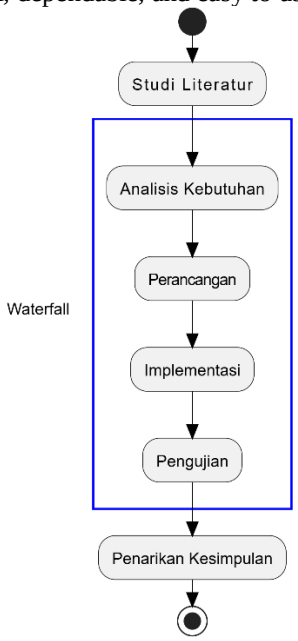

Figure 1. Research Methodology

3. RESULT AND DISCUSSION

3.1 Results
This study developed a web-based academic information and monitoring system for Madrasah Ibtidaiyah Negeri (MIN) Kudus using the Waterfall development model. The model's structured sequence ensured that each stage from requirements analysis to maintenance was implemented systematically. The main outcomes of development and testing are summarized below.

3.1.1 User Access Development
The system accommodates four categories of users: administrators, subject teachers, homeroom teachers, and students, each with specific access rights. Administrators manage master data (teachers, students, classes, subjects, and academic years), teachers focus on assessment planning and grade input, homeroom teachers record attendance and student notes, while students can access their grades and extracurricular records. Black-box testing confirmed that the role-based access control functioned properly and securely, with users restricted to relevant modules.

Table 1. Actor Table

No	Actor	Description

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1.	Admin	One of the people who has the authority to manage the system, all administrative and academic data of the school, including data on teachers, students, subjects, schedules, grades, and attendance. He/she has full access to all system modules.
2.	Teacher	Enters student academic grades and attendance, updates data on the subjects taught, and monitors student progress in the classes they teach.
3.	User/Parent	Access real-time academic and attendance information about their child through the website, and receive WhatsApp notifications regarding important information such as absences or school announcements.

3.1.2 Use Case Diagram

A use case diagram is a diagram that shows the relationship between actors and use cases[16]. Use case diagrams are created based on previously described functional requirements to simulate interactions between actors and use cases. Figure 2 shows this use case diagram.

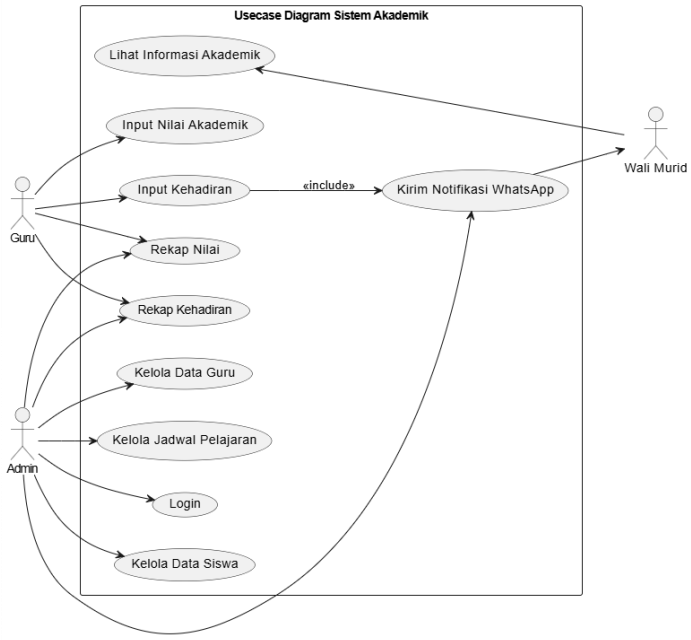

Figure 1. Use Case Diagram

3.1.3 Activity Diagram

The flow of functionalism in an information system is depicted in an activity diagram. Overall, an activity diagram shows where the process begins, where the process ends, what activities occur during the process, and how those events are sequenced[17]. Activity diagrams also offer an approach to parallel process modeling. This will appeal to those familiar with traditional structure design and analysis because it combines the underlying concepts of data flow diagrams and system flow diagrams[18]. Activity diagrams show the sequence of process activities between actors and systems, as shown in Figure 3.

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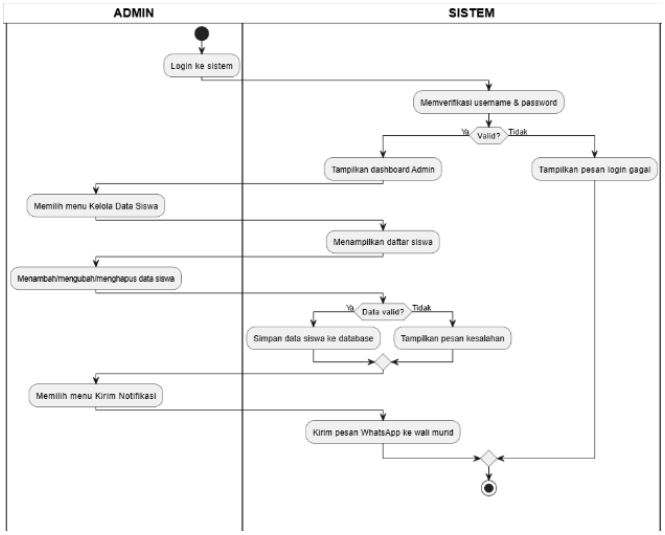

Figure 2. Activity Diagram Admin

3.2 System Interface Display

The system interface is designed to be user-friendly for administrators, teachers, and parents. The admin dashboard displays student data, teacher information, class details, and scheduling controls. Teachers have access to input grades, manage attendance, and monitor student progress. Parents can view grade summaries, attendance records, and receive automatic notifications via WhatsApp sent by the system.

3.2.1 Login Page

Figure 4 shows the login page provides secure, role-based access to the system. By ensuring that each user logs in with valid credentials, the platform maintains the confidentiality and integrity of academic data while preventing unauthorized access..

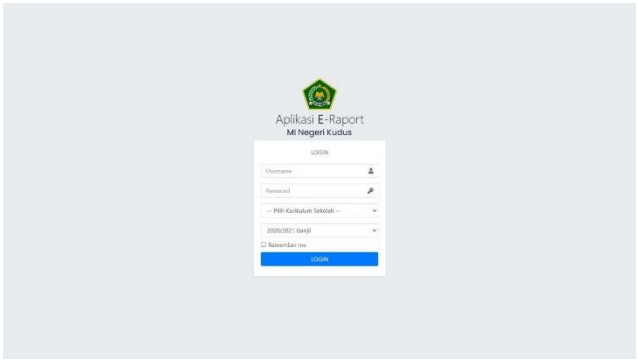

Figure 4. Login Page

3.2.2 Admin Dasboard

Figure 5 shows the admin dashboard functions as the central control hub for school data management. Administrators can manage master data such as teachers, students, subjects, and classes, as well as validate inputs and oversee user activity. These functions ensure that all academic records remain accurate, updated, and secure, which is essential for institutional accountability.

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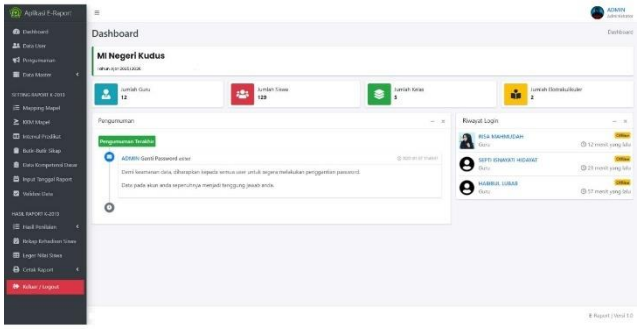

Figure 3. Admin Dashboard

3.2.3 Teacher Dashboard

Figure 6 shows the teacher dashboard interface enables real-time input and monitoring of student performance. Teachers can plan assessments, input scores, manage extracurricular evaluations, and generate descriptive feedback. By organizing results systematically, the dashboard reduces administrative burdens and ensures that student progress is tracked consistently across different subjects.

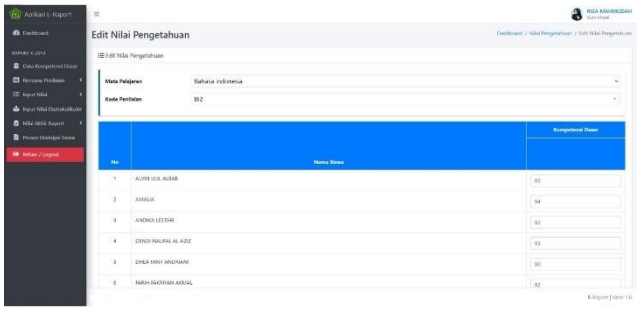

Figure 4. Teacher Dashboard

3.2.4 Homeroom Teacher Dashboard

The homeroom teacher dashboard supports comprehensive student monitoring. It consolidates subject grades submitted by teachers, attendance records, and attitude descriptions. Homeroom teachers can validate these records and generate report cards directly, which streamlines the reporting process and enhances the accuracy of academic documentation.

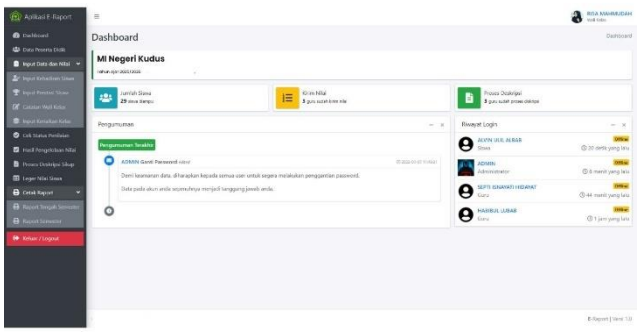

Figure 5. Class Teacher Dashboard

3.2.5 Student/Parent Dashboard

This view shows the student/parent dashboard page promotes transparency and parental engagement. Students and parents can view subject enrollment, extracurricular participation, attendance, and academic outcomes. Integrated

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with WhatsApp notifications, this dashboard provides real-time updates that keep parents informed and actively involved in the child's education.

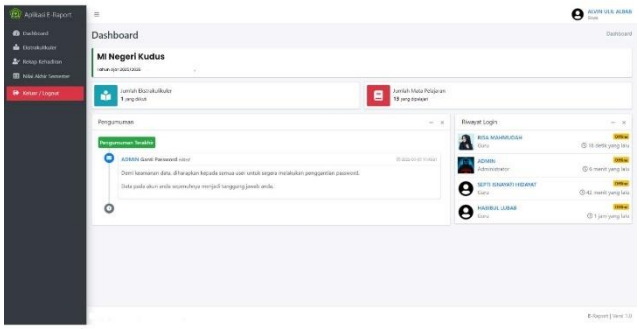

Figure 6. Parent Dashboard

3.3 System Features

Some of the key features that have been successfully implemented in this system include management of student, teacher, class, and subject data, input and monitoring of academic grades, recording of student daily attendance, automatic WhatsApp notifications to parents, and online access for parents to monitor student progress. Through the WhatsApp API, the system successfully sent real-time updates on attendance, grades, announcements, and progress reports directly to parents. All of these features are well integrated to support school administrative efficiency while increasing parental involvement in the educational process.

3.4 System Testing

Testing was conducted using the black box method to ensure that all features worked as intended. The test results showed that the system was able to input and update data properly, display relevant information, and send automatic WhatsApp notifications when students were absent or there were important announcements. Users stated that the system was easy to use and helped speed up administrative processes.

Table 2. System Testing

No	Access Rights / Features	Test Scenario	Expected Results	Actual Results	Conclusion
1	Login	User enters valid username & password	The system directs the user to the dashboard according to their user level	As expected	Valid
2	Login	User entered incorrect username/password	The system rejected the login and displayed an error message	As expected	Valid
3	Admin – Manage Users	Admin adds, edits, deletes user accounts	Data is stored and can be used to log in according to role	As expected	Valid
4	Admin – Manage Announcements	Admin creates, changes, and deletes announcements	Announcements appear on the student/teacher/class guardian dashboard	As expected	Valid

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No	Access Rights / Features	Test Scenario	Expected Results	Actual Results	Conclusion
5	Admin – Master Data	Admin manages school profiles, teacher data, academic years, subjects, classes, students, learning, extracurricular activities	Data is updated and can be used in all system features	As expected	Valid
6	Admin – Subject & KKM Mapping	Admin sets subjects and KKM standards	Mapping successful, KKM appears when inputting scores	As expected	Valid
7	Admin – Input Report Card Date	Admin sets report card printing schedule	Recorded date and restrict report card printing access	As expected	Valid
8	Administrator – Data Validation	Admin checks the completeness of the input values	The system displays the status of the input value	As expected	Valid
9	Admin – Access Student Grades & Results	Admin views student score recap	Grade data appears according to subject teacher input	As expected	Valid
10	Administrator – Print Report Cards	The administrator prints student report cards	The system generates PDF report cards based on student data	As expected	Valid
11	Teachers – Manage Basic Competencies	Teachers add, edit, delete Basic Competencies (KD)	KD data is stored and can be used for assessment	As expected	Valid
12	Teacher – Assessment Plan	Teachers set up assessment plans for knowledge, skills, spiritual, and social aspects	Weights are stored and displayed when inputting scores	As expected	Valid
13	Teacher – Grade Input	Teachers input student grades (knowledge, skills, attitude, midterm exams, final exams, extracurricular activities)	Grades are stored in the database and can be reviewed by students/homeroom teachers	As expected	Valid
14	Teacher – Process Description	Teachers generate descriptions of student learning achievements	The system displays automatic descriptions based on scores	As expected	Valid
15	Teachers – Submit Final Grades	Teachers send final grades to homeroom teachers	Data is locked and cannot be changed	As expected	Valid

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No	Access Rights / Features	Test Scenario	Expected Results	Actual Results	Conclusion
16	Homeroom Teacher – Student Data	Homeroom teachers access student data in their classes	Student data appears according to class	As expected	Valid
17	Homeroom Teacher – Attendance	Homeroom teacher inputs student attendance data	Attendance is stored and appears on the report card	As expected	Valid
18	Homeroom Teacher – Notes	The homeroom teacher adds homeroom teacher notes for students	Notes are saved and displayed in the report card	As expected	Valid
19	Homeroom Teacher – Promotion/Graduation	The homeroom teacher determines the promotion/graduation status	Status is saved and displayed on the student's report card	As expected	Valid
20	Homeroom Teacher – Ledger & Report Card	Homeroom teachers view grade summaries & print report cards	Ledger appears according to teacher data, report cards are printed according to format	As expected	Valid
21	Homeroom Teacher – Attitude Description	The homeroom teacher fills in the description of the student's attitude	The description appears on the report card	As expected	Valid
22	Student – Dashboard	Students log in and view summary data	The dashboard displays the number of subjects, extracurricular activities, and announcements	As expected	Valid
23	Students – Extracurricular Grades	Students view extracurricular grades	Scores appear according to teacher input	As expected	Valid
24	Students – Attendance	Students view attendance summary	Recap appears according to homeroom teacher data	As expected	Valid
25	Students – Final Grades	Students view their final semester grades	Grades appear according to subject teacher data	As expected	Valid

3.5 Discussion

3.5.1 Administrative Efficiency

Findings show that the system substantially reduced teachers' and administrators' workload, enabling them to focus more on instructional activities. This supports the findings of Lengkong et al. (2023), who highlighted that web-based academic systems streamline school data management and reduce administrative burdens . However, this study contributes specifically at the **elementary school level**, a context rarely explored in prior studies.

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3.5.2 Transparency and Parental Participation

The integration of WhatsApp notifications represents the primary novelty of this research. Unlike conventional academic systems, this feature closes the communication gap between schools and parents by providing real-time updates. This study validates and extends their conclusion by demonstrating practical implementation in an elementary school context, directly improving parental participation.

3.5.3 Contribution to Digital Transformation in Education

The urgency of digital transformation, accelerated by the COVID-19 pandemic, has been widely acknowledged. This system not only digitizes academic processes but also enhances communication, supporting Indonesia's national digital education agenda. OECD (2025) further stressed that effective communication strategies are integral to school digitalization, a recommendation operationalized by this study .

3.5.4 Comparison with Previous Studies

Several previous works developed web-based academic systems, but most focused solely on internal school efficiency without embedding direct communication channels with parents. The novelty here lies in combining academic management with real-time messaging integration, expanding the functional value of the system beyond the school environment.

3.5.5 Practical Implications

Practically, the system offers a replicable model for other elementary schools. Its use of WhatsApp ensures inclusivity since most Indonesian parents are familiar with the platform. Beyond efficiency, the system fosters active parental engagement, which is critical for holistic student development.

3.5.6 Theoretical Implications

Theoretically, this study broadens academic information system research by adding a participatory communication dimension. The system is not only a tool for data processing but also a medium for strengthening relationships among schools, teachers, students, and parents.

3.5.7 Limitations and Future Research

Despite its success, limitations include reliance on internet connectivity for WhatsApp notifications and the restricted scope of a single school case study. Future research should expand to multi-school contexts and integrate data analytics to monitor long-term student performance trends.

4. CONCLUSION

This study shows that building a web-based system for academic information and monitoring at Madrasah Ibtidaiyah Negeri Kudus is a big step forward in modernizing school management through digital tools. The main value of this system is that it brings together important academic tasks like recording grades, tracking attendance, keeping records of extracurricular activities, and making reports into one easy-to-use platform. This platform can be accessed by school leaders, teachers, students, and parents. One special feature is the use of automated WhatsApp messages, which helps keep communication between the school and parents strong and ensures important information is shared quickly. In addition to the technical side, the system helps by making administrative work easier, improves the accuracy of student records, and encourages parents to be more involved in their child's education. It also fits with Indonesia's plan to use digital tools in education, especially in madrasahs where the use of information systems is not widespread yet. This system can act as a helpful example for other schools wanting to move towards digital management.

However, there are some things that could be improved. Right now, the system needs a stable internet connection and is only available through a web browser. Future work could include creating a mobile app to make it easier for teachers and parents, especially in areas with limited internet access. Also, connecting the system with national education platforms like EMIS or SIMPATIKA would help share data more easily and support bigger goals for education management in Indonesia. In short, this research gives a working system for academic information and also takes a key step in the digital transformation of madrasah education. It sets up a foundation for more inclusive, efficient, and open school management.

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