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Web-Based Student Grade Management Information System

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Abstract

Digital transformation is pushing schools to adopt efficient academic information systems, but many schools in 3T areas including SMK Muhammadiyah Aimas still manage grades manually, making them prone to input errors, data duplication, and slow academic recap and reporting processes. This situation shows how important it is to find a systematic way to make value management more accurate, efficient, and open. This research aims to develop and evaluate a web-based system for managing value, designed to meet the needs of vocational schools in a limited context. Using a Research and Development (R&D) approach, the developed system integrates master data management, daily values, midterm exams, final exams, attendance, and automatic final grade calculation. The test results show that all features function according to specifications, while expert validation places the software aspect in the "very good" category. Usability testing by teachers yielded a score of 93%, indicating a high level of ease of use, satisfaction, and utility. The novel contribution of this research is the creation of a web-based value system that amalgamates value and attendance automation within the framework of 3T schools, a subject that remains infrequently examined. The study's limitations include the absence of API integration and its focus on a single school for evaluation. Nevertheless, this system has important implications for improving teachers' work efficiency and accelerating school digitalization in 3T.

Keywords: Information System, Grade Management, Web-Based, R&D, SMK Muhammadiyah Aimas

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INTRODUCTION

Digital transformation in education has become a global trend (Leal Filho et al., 2024) (Zain, 2021), driving institutions to manage learning processes and academic administration more effectively and transparently (Ramdhan et al., 2022)(Carmody, 2019). One notable advancement is the implementation of web-based academic information systems, which automate student data management and accelerate the delivery of academic information (Liu et al., 2022). Internationally, these systems are often integrated with learning analytics and cloud-based databases, enabling real-time monitoring of learning outcomes (Leitner et al., 2020)(Munagandla et al., 2023).

In Indonesia, national policies promoting digital transformation in education have encouraged the development of school information systems (Wahab, 2024). However, implementation remains challenging, particularly in 3T (frontier, outermost, and disadvantaged) regions, due to limited technological infrastructure,

human resources, and technical capacity (Aditya et al., 2021) (Idroes et al., 2023). These challenges are especially pronounced at the vocational high school (SMK) level, where efficient grade management is vital because of the large number of practical and theoretical subjects and the need for fast, accurate reporting of learning outcomes.

Observations and interviews at SMK Muhammadiyah Aimas reveal that student grade management is still handled manually or semi-digitally using basic applications like spreadsheets. This situation leads to several issues, including time-consuming grade recapitulation, potential input errors and data duplication, and delays in academic reporting. Such problems hinder the efficiency of teachers and administrative staff and negatively impact the accuracy of academic evaluation.

While previous studies on web-based academic information systems and grade management have focused on vocational schools in urban areas or regions with adequate infrastructure (Lengkong et al., 2023)(Zhao et al., 2024), there is a notable lack of research specifically addressing the development and implementation of such systems in 3T areas. Schools in these regions face more complex challenges, such as unstable internet access and limited resources. This highlights a significant research gap that needs to be addressed to ensure equitable and inclusive digitalization in education.

In line with Indonesia's national agenda, as expressed in the Merdeka Belajar and Digital School 2025 policies (Wang, 2023). the development of a grade management information system at SMK Muhammadiyah Aimas is expected to provide a concrete solution to the existing problems. Moreover, it can enhance the quality of vocational education services through more efficient and data-driven grade management (Sulaiman, 2021).

Based on this background, the objectives of this study are: (1) to design and develop a web-based student grade management information system at SMK Muhammadiyah Aimas, and (2) to evaluate the effectiveness and efficiency of using this system to support the grade management process. It is anticipated that the system will improve teacher performance, increase data accuracy, speed up the reporting process, and overall foster a more modern and efficient educational environment at SMK Muhammadiyah Aimas, particularly in a 3T region.

METHODS

This study adopts a Research and Development (R&D) approach, which is considered highly appropriate for research aimed at producing a new product in this case, a web-based student grade management information system for SMK Muhammadiyah Aimas. The R&D method is widely used in engineering and technology-related fields as it provides a systematic framework for the design, development, testing, and evaluation of innovative products (Jusuf, 2023)(Hina, 2025). In this context, the R&D approach is particularly suitable because the study not only analyzes existing problems but also develops a tangible technological solution tailored to the needs of the school (Shalaby, 2024), especially in the context of a 3T region with specific challenges in infrastructure and resource availability.

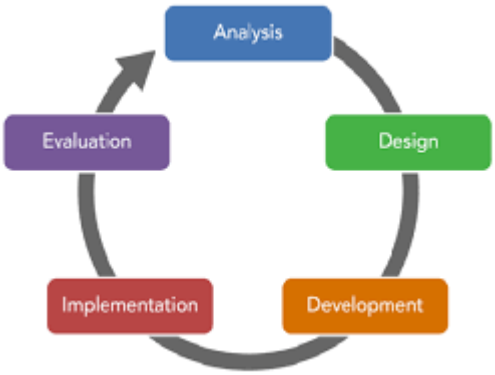

Figure 1. Stages of Research and Development (R&D) (Taherdoost, 2024)

The R&D process in this research consists of several key stages:

1. Analysis
   The study begins with a needs analysis, including observations, interviews, and documentation at SMK Muhammadiyah Aimas. This stage identifies the limitations of the current grade management process, the requirements of teachers and administrative staff, and the specific challenges faced in a 3T area.
2. Design
   Based on the analysis, the system design stage involves creating system architecture, user interface (UI) mockups, and data flow diagrams. The design is tailored to be user-friendly and accessible, considering the limitations of internet connectivity and the digital literacy level of users at the school.
3. Development
   The next stage is the actual development of the web-based grade management information system. This process involves coding the system, integrating necessary features, and preparing the database. The development is iteratively refined based on feedback from potential users.
4. Implementation
   After development, the system undergoes functional and usability testing. Teachers and administrative staff are involved in testing the system in real conditions at the school, and their feedback is collected to identify any issues or areas for improvement.
5. Evaluation
   The final stage is evaluation, which assesses the effectiveness and efficiency of the system in supporting grade management at SMK Muhammadiyah Aimas. Data is gathered through questionnaires, interviews, and system usage logs to measure improvements in work processes, data accuracy, and reporting speed.

The choice of the R&D model is justified by the study's aim to produce not just a theoretical solution, but a practical, implementable system that responds to the real needs and constraints of vocational schools in disadvantaged regions. The structured steps of R&D ensure that the developed product is relevant, reliable, and effective for its intended context (Muthmainnah, 2025).

RESULTS & DISCUSSION

System Development Results

Based on the results of this study, a web-based Student Grade Management Information System has been successfully developed for subject teachers at SMK Muhammadiyah Aimas. This system is a response to the problem of student grade management, which was previously done manually or was not fully integrated. The developed system provides a comprehensive grade management module, ranging from master data input, daily grade processing, midterm exams, final exams, attendance, to the automation of final grade calculations. The system interface is designed to be easy to use, and features such as exporting reports to Excel are expected to improve teacher work efficiency.

Figure 2 shows the login page of the Student Grade Management Information System, where users (admins and teachers) must enter their registered username and password. Access is restricted based on user roles; admins manage master data (teachers, students, classes, subjects, schedules, attendance, announcements), while teachers manage student grades. After credentials are verified, users will be directed to their respective dashboards, ensuring that only authorized users can access the system to maintain data security and integrity.

Figure 2. Admin and Teacher Login Page

Figure 3 presents the admin dashboard, which serves as the primary interface for school administrators within the developed system. The dashboard is designed to provide a clear overview of essential school data and facilitate efficient access to administrative functions. Key information, such as the number of teachers, students, classes, and subjects, is visually summarized to support data-driven decision-making.

The arrangement of features on the dashboard reflects the priorities identified during the needs analysis phase, ensuring that administrators can quickly monitor school operations and access core management tools. This design aims to streamline administrative workflows, reduce navigation time, and enhance the overall user experience. The research findings indicate that the dashboard's concise and organized layout contributes to improved efficiency in managing school data,

supporting the broader objective of digital transformation in educational administration at SMK Muhammadiyah Aimas.

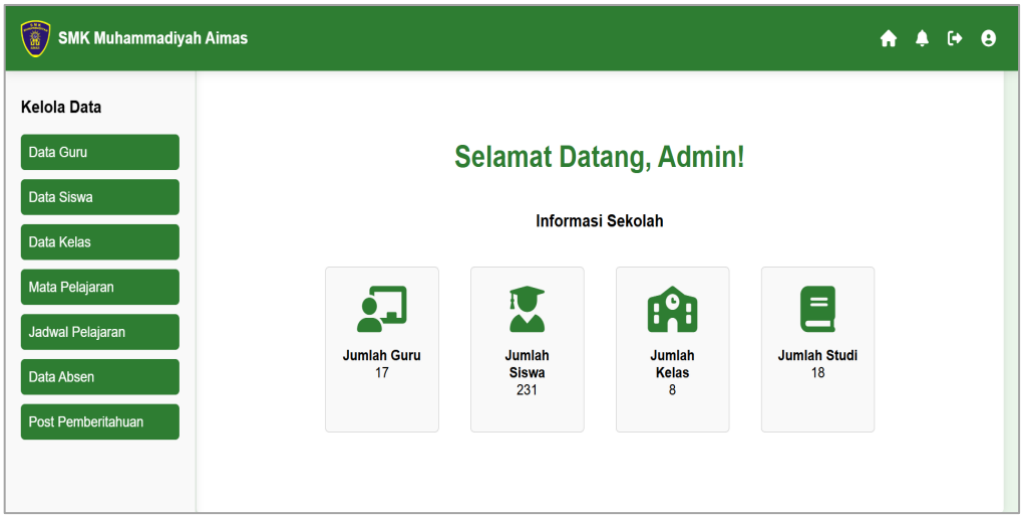

Figure 3. Admin Dashboard Page

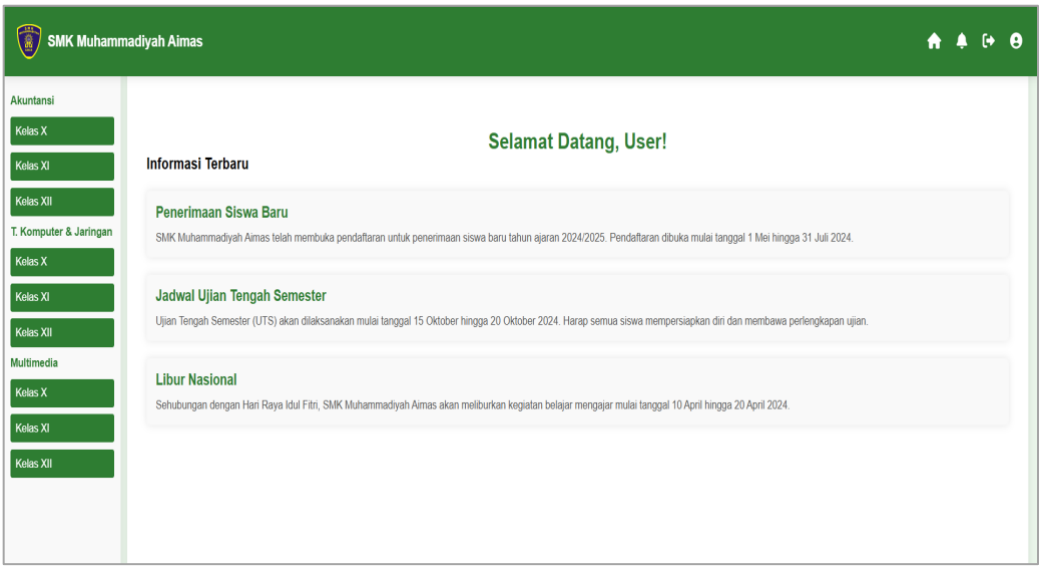

Figure 4. Teacher Subject Dashboard Page

Figure 4 illustrates the teacher dashboard, which was developed to support teachers in efficiently managing their academic responsibilities. The dashboard provides streamlined access to relevant class and student information, as well as real-time updates on school activities. By consolidating essential features such as grade entry, student data access, and timely notifications into a single interface, the dashboard addresses the practical needs identified during the analysis phase. Research findings show that this targeted design helps teachers navigate their tasks more quickly and reduces administrative burdens. The integration of real-time information and accessible data management tools enhances workflow efficiency and supports more effective teaching and assessment processes at SMK Muhammadiyah Aimas.

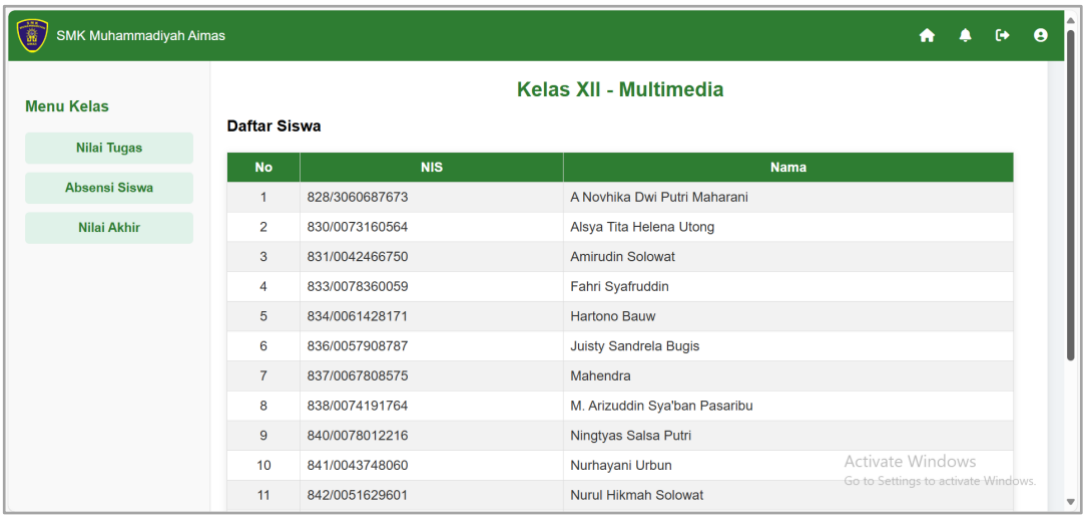

Figure 5. Class Data Page

Figure 5 shows the class data page in the subject teacher module. This page displays a list of students in the class selected by the teacher, with the class title displayed at the top. On the left side, there is a navigation menu that allows teachers to access the "Assignment Grades," "Student Attendance," and "Final Grades" features for that class. The main section of this page presents a table listing students, including their numbers, student ID numbers, and names. This design aims to make it easier for teachers to manage and monitor student academic progress and attendance in an integrated and efficient manner in a single view.

Figure 6. Student Grade Input Data Page

Figure 6 shows the student grade input page, which teachers use to enter student assignment grades for a particular class. This page displays student data in a table, consisting of columns for student names, student ID numbers, and input columns for assignment grades (from assignment one to assignment eight). Teachers can directly enter grades in the available columns, and the "Average

Score" column will automatically calculate the total score for all assignments entered.

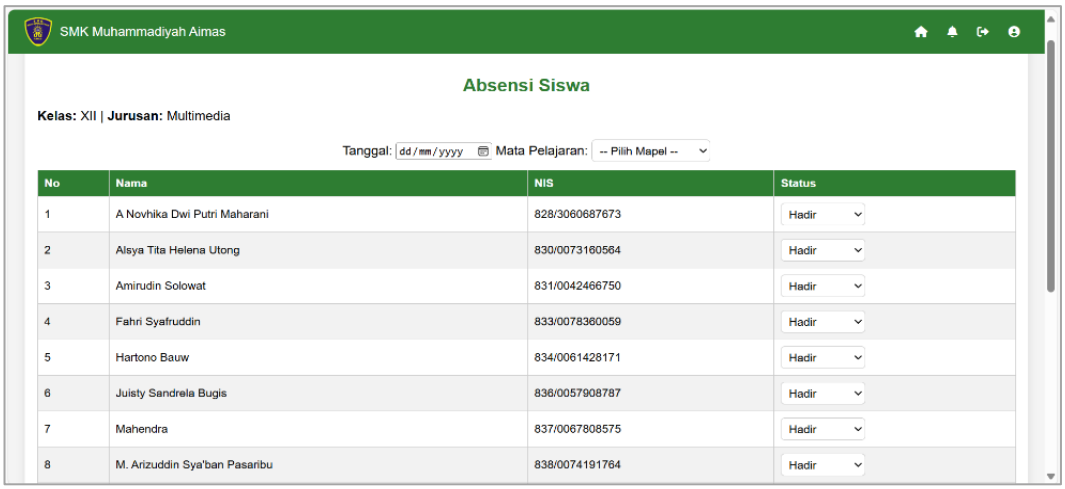

Figure 7. Student Attendance Data Page

Figure 7 shows the Student Attendance Data page. This page displays a list of students in the selected class, presented in a table format with columns for number, student name, student ID number, and attendance status. At the top, there is information about the class name and major, as well as options to select the date and subject of attendance. Teachers can input attendance by selecting the attendance status (Present, Absent, or Permission) for each student through the available dropdown menu, allowing for quick and structured attendance recording.

Figure 8. Saved Attendance Page

Figure 8 shows the page where student attendance data entered by teachers is stored in the system. Student attendance status is represented visually with color codes: blue for "Present," yellow for "Excused," and red for "Absent." This representation makes it easy to identify student attendance status in real time. This

page also includes a recap feature that teachers can use to summarize student attendance at the end of the semester.

Figure 9. Student Attendance Summary Page

Figure 9 shows the student attendance summary page for one semester. This page provides a comprehensive overview of all student attendance data stored in the system. Subject teachers can view a summary of each student's attendance, including the total number of attendances, permissions, and absences, presented in an easy-to-read table format. This summary feature is designed not only to make it easier for teachers to monitor student attendance records and compile attendance reports per semester, but also to automatically integrate and display the attendance data in the attendance column on the student's final grade page.

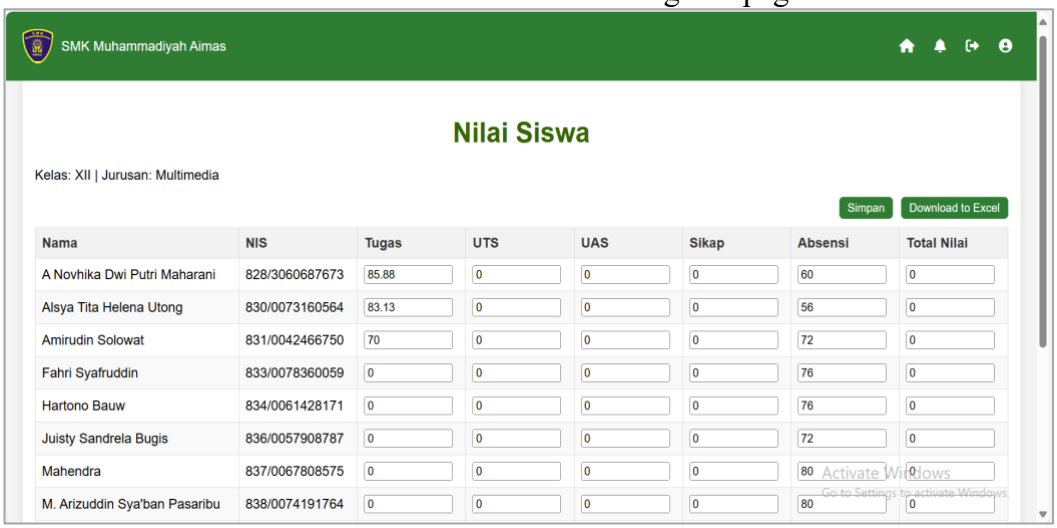

Figure 10. Final Grade Data Page

Figure 10 shows the Final Grade Data Page, an important interface for subject teachers to manage and summarize student grades. This page displays a list of students per class, complete with their names, student ID numbers, and columns for various grade components such as daily assignments, midterm exams, final exams, attitude, and attendance, as well as a column for the final total score.

Teachers can enter midterm, final, and attitude grades, while daily assignment grades and attendance data will appear automatically from previous inputs. The system automatically calculates the final grade total, and teachers can export this data to a spreadsheet (Excel) format to facilitate reporting to homeroom teachers.

System Testing Results

Functionality testing of the system was conducted using the Black Box Testing method. The test results showed that the system functioned properly without any errors found in any of the functions tested. This indicates that the system is valid and all features work according to their expected and designed functionality.

After functional testing, the system and research instruments were validated by expert validators. This validation process aimed to assess the suitability of the product from a scientific and practical perspective. The results of the system and instrument design validation indicate that the system is suitable for use at SMK Muhammadiyah Aimas. There were a few revisions to several sentences in the respondent instrument sheet to improve clarity, but overall, expert validation confirmed the quality and relevance of the system.

Program aspects are evaluated by expert validators to measure the technical quality and design of the system that has been created. This evaluation consists of two main indicators: software and design. A summary of the results of the expert validation assessment of these indicators can be seen in Table 1.

Table 1. Assessment Results of Program Aspects

No.	Indicator	Percentage	Category
1	Software	90%	Very Good
2	Design	71%	Good
Total		**80%**	**Very good**

Usability testing was conducted on subject teachers as research subjects at SMK Muhammadiyah Aimas. This testing measured three main aspects: usefulness, satisfaction, and ease of use. The results of the analysis showed a very positive percentage. The respondents' assessment of the system can be seen in Table 2. Overall, the usability testing results obtained a percentage of 93% in the “Very Good” category. This confirms that the developed system is well received by users and is considered very useful, satisfying, and easy to operate by subject teachers.

Table 2. Usability Testing Results by Respondents

No.	Assessment Aspects	Percentage	Category
1	*Usefulness*	92%	Very Good
2	*Satisfaction*	94%	Very Good
3	*Ease of Use*	94%	Very Good
Total		**93%**	**Very Good**

In addition to user satisfaction, the system is also evaluated based on predetermined effectiveness and efficiency indicators, including:

Data Accuracy: Based on the results of functionality testing (Black Box Testing) and confirmation from expert validators, this system successfully records and reports student grade data with high accuracy. All data entered by teachers is

stored and displayed consistently with the initial input, significantly minimizing the potential for manual errors that often occurred in the previous grade management process.

Processing Speed: In terms of efficiency, the system shows a substantial increase in data processing speed. The questionnaire results on the time efficiency indicator (fifth item of the usefulness aspect) show an represents 92% achievement. This figure clearly reflects that the majority of teachers feel that the process of processing scores and generating reports has become faster and more responsive, effectively reducing the time required compared to the previous manual method.

Availability and Accessibility: This system demonstrates an excellent level of availability and accessibility. Functionality testing (Black Box Testing) results and confirmation from expert validators confirm that the system can be accessed optimally via a web browser anytime and anywhere. This ensures flexibility for users to process data in real-time without significant obstacles, thereby increasing teacher work efficiency.

Integration and Interoperability: Although the system is not designed to integrate directly with other administrative systems via API, its ability to generate final grade reports and monthly attendance summaries in spreadsheet format (Excel) facilitates data interoperability. This format allows grade data to be easily presented to homeroom teachers or integrated into other reports without requiring manual input, which significantly supports school reporting efficiency.

Discussion

The results of the system development show that the web-based Student Grade Management Information System at SMK Muhammadiyah Aimas has successfully accommodated the basic needs of teachers and school administrators in the grade management process, ranging from master data input, daily grades, midterm exams, final exams, attendance, to automatic final grade calculation. This success is consistent with the findings of (Hendra, 2017) in the study on web-based student grade information system design, which states that web-based systems simplify the checking and reporting of student grade data and reduce teachers' workload (Solehuddin et al., 2021) (Febriani, 2023). Additionally, research by (Mahardian & Silalahi, 2022) at SMK Teladan Batam also found that web-based systems can accelerate the grading process and facilitate teachers' access to the latest grades, mirroring the increased efficiency observed in this study (Paramitha & Susanti, 2021) (Sumbaryadi & Christo, 2019).

In terms of usability, this system received a total score of 93% based on testing with teachers a result that indicates a very high level of user acceptance. This supports the usability evaluation approach in academic system s previously reviewed by (Hendra & Arifin M.M., 2018) through their publication on web-based usability measurement for student grading, which emphasizes the importance of empirical usability measurement instruments such as the USE Questionnaire (Nugraha & Jumasa, 2020) (Sidhawara, 2022). Other studies on academic system evaluation show that information quality, responsiveness, and user satisfaction are dominant factors in the usability of web-based academic systems (Pamungkas & Sintaro, 2025) (Maulana et al., 2023). These findings reinforce that interface design

(UI), system response speed, and clear information delivery are crucial elements for the successful adoption of such systems by teachers and other users (Doctor, 2017).

In terms of effectiveness and efficiency, this system has been proven to significantly speed up the process of processing scores and generating reports automatically. This is in line with research on e-reports at SMA Negeri 12 Kota Jambi, where the use of a web-based system reduces redundancy and overcomes data inconsistencies that arise from the use of manual spreadsheets (Excel) (Febriani, 2023). Similarly, research on the Grade Data Information System at SMK Negeri 03 Empat Lawang reported that grade management using Excel was unable to handle large volumes of data or centralized data integration, making a centralized web-based system an urgent necessity (Ulandari & Zulfiandry, 2025). Thus, the system developed in this study not only fulfills basic functions but also provides real improvements in speed, accuracy, and data interoperability compared to the old method.

Overall, the results of this study show that the development of a web-based Student Grade Management Information System at SMK Muhammadiyah Aimas has theoretical and practical relevance. Its theoretical relevance lies in proving that the application of a web-based system can improve the effectiveness and efficiency of teachers' work, while its practical relevance is evident from the positive acceptance of users and improvements in the quality of academic management at the school. With the integration of real-time grade and attendance features, this study expands on the contributions of previous studies by adding aspects of usability testing, effectiveness, and the context of implementation in 3T (underdeveloped, frontier, and outermost) areas, which have rarely been studied before (Sumbaryadi & Christo, 2019).

ACKNOWLEDGEMENT

Based on the results of research and a series of tests that have been conducted, it can be concluded that the development of a web-based Student Grade Management Information System at SMK Muhammadiyah Aimas has successfully provided an effective solution to the problem of grade management, which was previously done manually and inefficiently. This system has proven capable of overcoming various obstacles that arise in the grade processing process, such as the length of time required for recapitulation, the high potential for data input errors, and delays in providing academic reports. Through the implementation of a web-based system, the grade management process has become faster, more accurate, and more integrated, thereby supporting increased work efficiency for teachers and strengthening the quality of academic evaluation at the school.

he results of testing using the Black Box Testing method show that all features in the system function properly without any errors, indicating that the system has met the expected functionality standards. From the usability testing results conducted on subject teachers, a user satisfaction level of 93% was obtained, categorized as “Very Good.” These findings indicate that the system is not only useful and convenient for users, but also provides a positive user experience in terms of ease of operation, satisfaction, and work effectiveness.

The implementation of this system has made a real contribution to improving the quality of academic services at SMK Muhammadiyah Aimas and supports the implementation of national policies such as Merdeka Belajar (Freedom of Learning) and Digital School 2025, which encourage digital transformation in education. Thus, the results of this study indicate that the developed system can be used as a model for other vocational high schools in realizing modern, integrated, and adaptive value management to meet the needs of education in the digital era.

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