

Analysis and Design of E-Report Card System at SMAN 6 Muaro Jambi Using SSAD

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ABSTRACT

Manual management of report cards at SMAN 6 Muaro Jambi often leads to recording errors, data loss, and limited access to real-time academic information, which hinders effective communication between schools, teachers, students, and parents. This study aims to analyze and design a web-based E-Report Card system using the Structured System Analysis and Design (SSAD) method as a structured and reliable solution to these challenges. The SSAD approach was applied through several stages, including problem identification, requirement analysis, system design using Data Flow Diagrams (DFD), Entity Relationship Diagrams (ERD), and wireframes, followed by prototype evaluation through usability testing. The evaluation process utilized Maze as a usability testing tool to assess the system's interface performance using the Mean Adjusted Usability Score (MAUS). The analysis results produced a system design that features structured data flow, an integrated database, and an interactive user interface prototype tailored to stakeholder needs. The usability testing results indicated the highest MAUS score for Students/Parents users (93), while Subject Teachers obtained the lowest score (67), suggesting the need for interface improvement for better task efficiency. Overall, the designed web-based E-Report Card system demonstrates the potential to overcome inefficiencies in manual report card management while enhancing accuracy, transparency, and accessibility of academic information in schools.

INTRODUCTION

In the digital age, the transformation of academic data management has become crucial to supporting a transparent and accessible teaching and learning ecosystem. Report cards are fundamental documents that reflect students' competency achievements and serve as the primary means of communication between schools, students, and parents. However, the conventional process of compiling report cards still faces various obstacles, such as the risk of damage or loss of physical documents, distribution inefficiencies, and limited real-time access to information. Specifically, State Senior High School (SMAN) 6 Muaro Jambi faces these challenges, where the manual system that is implemented is prone to recording errors, causing delays in information, and requiring the physical presence of parents to monitor their children's academic progress. As a result, there is a gap between the need for modern data management and existing practices, which has the potential to weaken the effectiveness of communication and impact student motivation to learn.

As a strategic solution, the design of a web-based E-Report system offers the potential to effectively address these issues, as proven by its efficiency in previous studies. Previous research by Irfa Nufaiyal Kharish (2021) shows that web-based report applications are proven to be effective, efficient, easy for teachers to use, and can overcome data redundancy issues in managing student grades. On the other hand, Abdussalaam & Badriansyah, (2021) successfully applied the Structured System Analysis and Design (SSAD) method in designing a more efficient web-based goods inspection information system. Studies in the local context in Jambi tend to adopt system development methods within the general framework of the Software Development Life Cycle (SDLC), with the dominant use of the Waterfall method (Dauli, 2022). The Waterfall method is known for its linear and sequential approach, but it is often criticized for being rigid and inflexible to changing requirements during the development process. In practice, the application of SDLC is rarely completely linear because each stage of information system development tends to overlap and involve inevitable iterative processes (Mohan, 2022).

As an alternative, the Structured System Analysis and Design (SSAD) method offers a process-oriented approach, focusing on in-depth analysis and modeling of workflows before entering the technical design stage. SSAD uses visual aids such as Data Flow Diagrams (DFDs) to map data flows, which are particularly relevant for structured workflows such as the report card preparation process. The success of SSAD in designing other structured information systems has been proven (Abdussalaam & Badriansyah, 2021). However, there is a scarcity of studies that specifically apply and evaluate the SSAD method for designing an e-Report system at the secondary school level in the local context of Jambi. This research gap lies in the lack of methodological exploration of SSAD as an alternative that has the potential to produce a more logical and reliable system design for well-defined educational administration functions.



Based on this research gap, the main objective of this study is to analyze and design a web-based E-Report system at SMAN 6 Muaro Jambi by applying the SSAD method. The expected contributions are practical and academic. Practically, this study will produce a structured system blueprint that is ready to be implemented at SMAN 6 Muaro Jambi and can be used as a reference model for other schools. Academically, this research demonstrates the application of the SSAD method in the context of educational information systems, fills the gap in studies that has been identified previously, and ultimately supports the vision of improving national education quality through digitalization.

LITERATURE REVIEW

E-Report is a web-based academic information system that enables the secure and structured management and storage of student grade data, minimizing the risk of data loss or damage (Febriyanto et al., 2020). The development of E-Report as a web-based academic reporting system has been the focus of much research due to its potential to improve the efficiency of grade processing, transparency, and accessibility of academic information. Studies on the planning and implementation of E-Rapor show that web-based applications can replace manual processes that are prone to errors and accelerate the distribution of report cards (Febriyanto et al., 2020; Kurniawan & Muhaimin, 2022).

The Structured System Analysis and Design (SSAD) method is a structured approach used to design information systems and can be applied at the system analysis and design stages (Santosa & Setiawan, 2018). Structured approaches such as SSAD provide a systematic analysis framework through the use of Data Flow Diagrams (DFDs) and Entity Relationship Diagrams (ERDs), thereby facilitating data flow mapping, entity identification, and the technical specifications required for reliable system implementation. Entity Relationship Diagrams (ERDs) describe the overall logical structure of data in a database (Wulandari & Jauhari, 2022). Meanwhile, Data Flow Diagrams (DFDs) explain the flow of information and data transformation from input to output (Dewi et al., 2023). In product development, a crucial aspect to consider is usability evaluation (Praseptiawan et al., 2023). Testing for the evaluation of the usability of this system was carried out using Maze, a task-based testing tool that serves to systematically assess the level of efficiency, effectiveness, and user satisfaction (Fitri et al., 2024). The results of this testing were then analyzed and produced a MAUS score, which is a quantitative index for measuring the ease and success of users in completing tasks in the prototype.

METHOD

The selected system development method is the Structured System Analysis and Design methodology (SSAD), which is based on breaking down complex system problems into simpler or smaller modules. Through this method, complex problems can be solved and result in a flexible, maintainable, and well-documented system. The steps or stages of the SSAD method are:

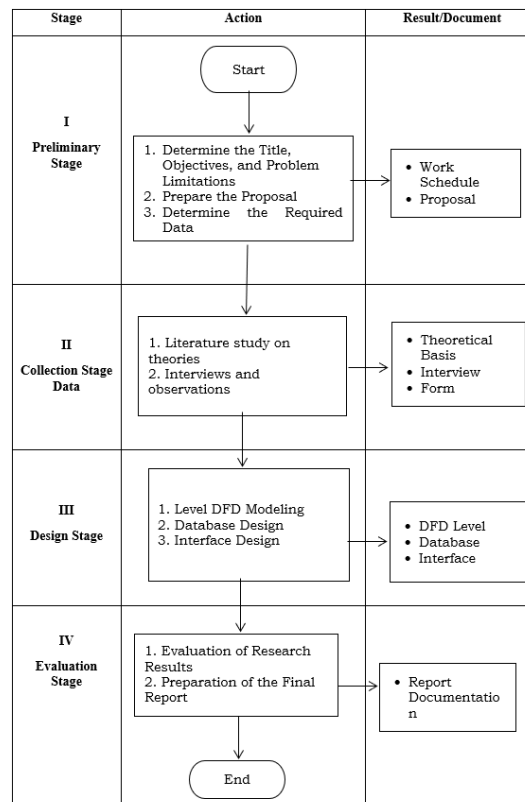


Fig. 1 Research Flowchart



Preliminary Stage

The initial stage of the research included identifying problems, analyzing needs, and setting a schedule for system development. At this stage, the researchers formulated the background, problem limitations, research objectives, and expected benefits. In addition, preliminary data collection was carried out in the form of data on teachers, students, and subjects at SMAN 6 Muaro Jambi. A literature study was also conducted, using books, scientific journals, and various reliable and relevant sources that supported the research needs (Rochman et al., 2019).

Collection Data & Analysis Stage

Data collection was carried out through observation, interviews, and literature studies from books, journals, and related documents, while analysis was carried out to process the collected data through needs identification, business process mapping, and user role definition. The purpose of applying analysis to a system is to understand the reasons for the system's needs, formulate requirements for more efficient use of resources, assist in planning the system development schedule, and minimize disruptions so that the functions within the system can run optimally (Effendy et al., 2022).

Design Stage

The design stage aims to produce detailed system specifications based on the results of the analysis. System design includes modeling information system components, working mechanisms, and user interfaces to suit requirements. This design produces a Data Flow Diagram (DFD) model that describes the flow of data in the system in a structured manner, from the context level to the detailed level (Ratnaningsih & Rifai, 2024). DFD is used to facilitate understanding of system logic, while the database is designed to organize and manage the required data (Dzakiyyah et al., 2021). In addition, the interface design is arranged to be easy to operate and attractive to users.

Evaluation Stage

Evaluation is carried out in stages using the SSAD approach, starting from requirements evaluation, design evaluation, to prototype evaluation. Requirements evaluation is carried out by validating the requirements document with users to ensure its suitability. Gap analysis is also carried out to identify features that have not been fulfilled. Next, design evaluation includes checking the suitability of SSAD diagrams and usability testing using Maze tools. After that, the E-Report system prototype is tested directly by users to obtain feedback. This evaluation process is iterative until the prototype is considered to meet user needs and is easy to use.

RESULT

Analysis Stage

1. Problem Identification

Based on observations at SMAN 6 Muaro Jambi, report cards are still processed manually using paper or spreadsheets, which are prone to errors, data loss, and difficulties in long-term storage. The distribution of report cards is also inefficient because parents must come to the school in person, while academic information is only available at the end of the semester, limiting parental involvement in monitoring their children's progress. As the number of students increases, data management becomes more complex and the manual system is unable to optimally support evaluation and decision-making needs. Therefore, it is necessary to implement a web-based E-Report Card using the Structured System Analysis and Design (SSAD) method to provide an integrated, accurate academic information system that supports the improvement of education service quality.

2. Need Analysis

a. Fungtional Requirment

Table 1. Fungtional Requirment

No.	Fungtional Requirment	Description
1.	User Authentication	The system provides secure login for administrators, teachers, students, and parents.
2.	Credential-Based Access	Teachers use their NIP (Civil Servant Identification Number), students and parents use their NISN (National Student Identification Number), and administrators use their username and password.
3.	Grade Management	Teachers can enter grades for each subject electronically.
4.	Grade Recap	The system provides a recap of grades per semester/school year.
5.	Attendance Recording	Teachers record student attendance digitally.
6.	Academic Reports	Compiles academic reports, extracurricular activities, and development project grades
7.	Student Progress Monitoring	Tracks student learning progress over time.
8.	Progress Notes	Stores student counseling and non-academic development data
9.	Parent/Student Access	Parents can view their children's grades, attendance, and progress online.
10.	Student Academic History	Displays students' academic records from year to year.
11.	User Management	Admins manage user access and permissions according to their roles.

b. Non-Functional Requirement

- The system can be run by several web browsers, including Internet Explorer, Google Chrome, and Mozilla Firefox.
- To synchronize data and provide real-time information, users must be connected to the internet when accessing the E-Report web system.
- Users can easily use the system because the system's user interface is easy to understand.

c. Business Process Analysis

The manual report card creation process is a series of activities ranging from the collection of daily grades, assignments, midterm exams, and final exams by subject teachers to recording them in grade books, supplemented with non-academic data such as attendance, discipline, and attitude collected by homeroom teachers. After that, the report cards are verified by the principal and vice principal before being approved with the principal's signature. However, this manual process still has various limitations, such as the potential for human error, time inefficiency, and difficulty in tracking grade history digitally.

Design Stage

1. DFD Level Modeling

Data Flow Diagram (DFD) modeling is used to describe the data flow that occurs within the E-Report system. Level 0 DFD or context diagram explains the relationship between the system and external entities, such as teachers, students, parents, and administrators. The data flow shown describes the main processes of the system, such as inputting grades, managing report data, and distributing information to parents.

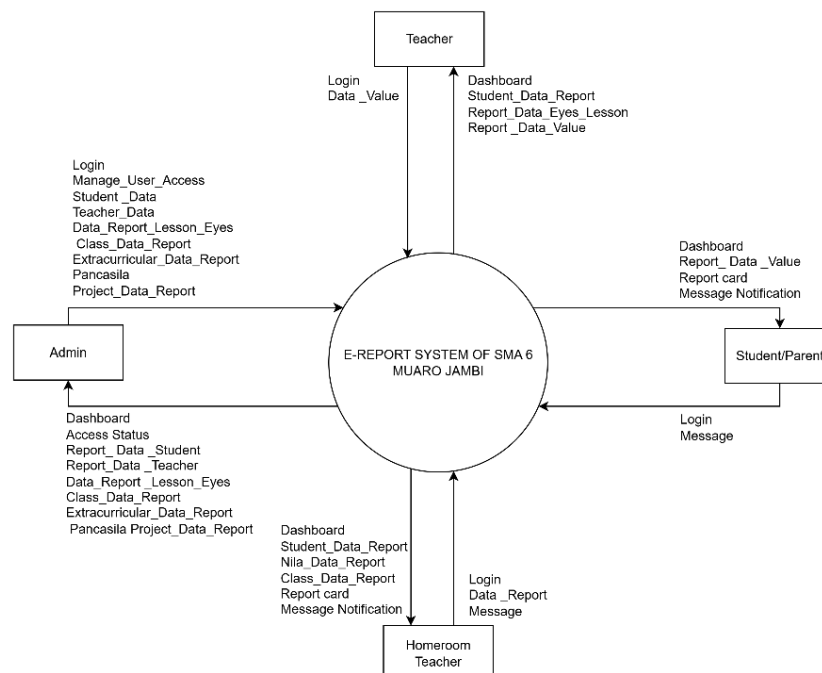


Fig. 2 DFD Level 0

DFD Level 1 then details the main processes at the context level into more detailed sub-processes. For example, the process of inputting grades is broken down into inputting student data, inputting assignment grades, inputting exam grades, and processing final grades. This stage also explains how data flows to the database and is then displayed in the form of report cards that can be accessed by teachers, students, and parents.

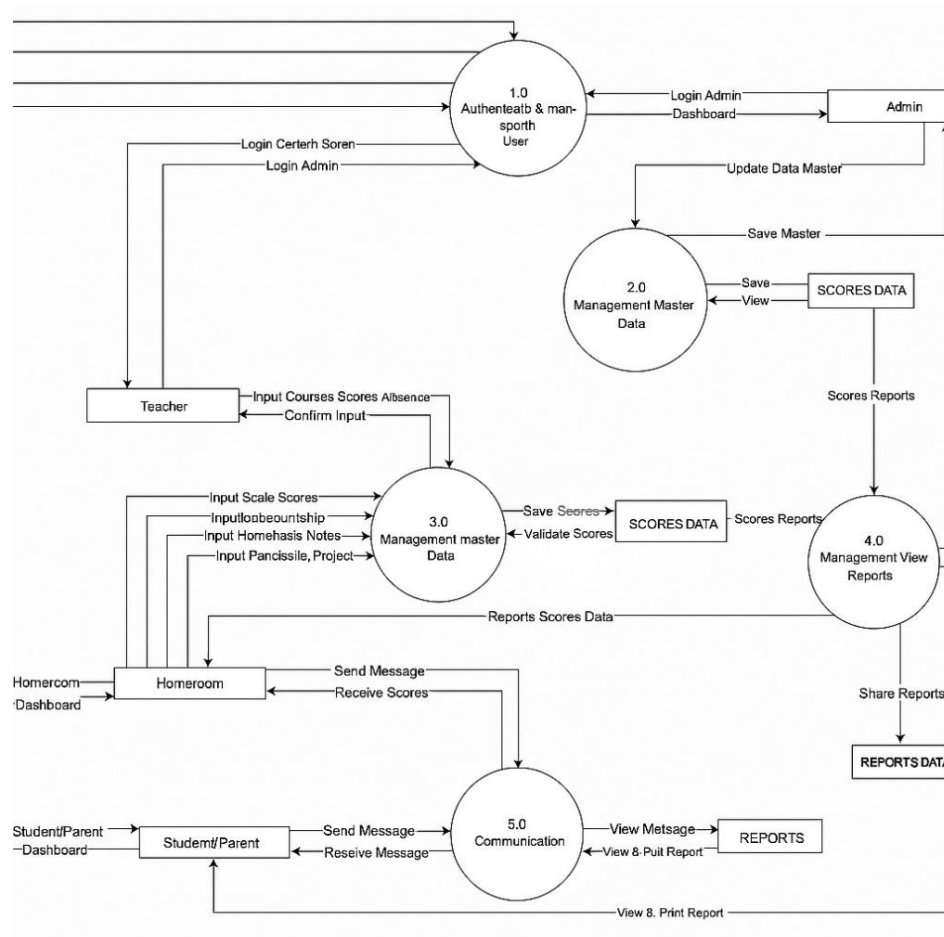


Fig. 3 DFD Level 1

2. Database Design

Database design is carried out using Entity Relationship Diagrams (ERDs) to model the entities involved and their relationships. The main entities in the E-Report system include Teachers, Students, Classes, Subjects, Grades, and Reports. The purpose of this design is to ensure that academic data is stored consistently, securely, and in a structured manner, thereby minimizing redundancy and recording errors.

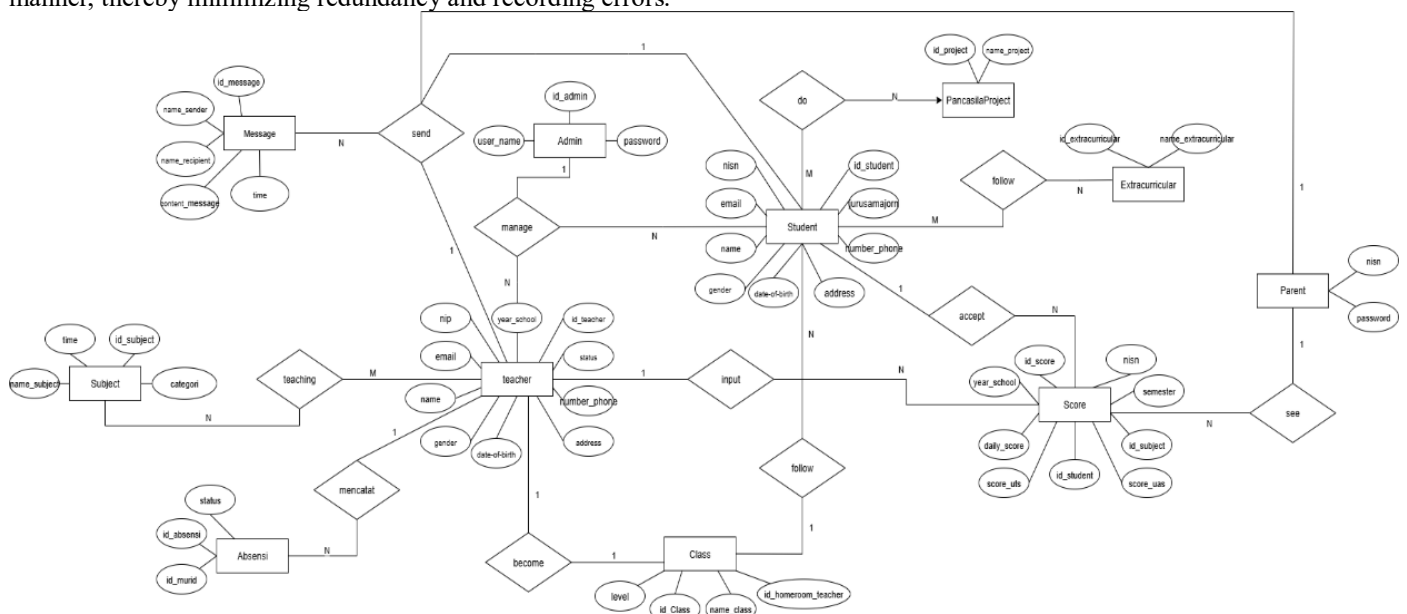


Fig. 4 Entity Relationship Diagram (ERD)

3. Interface Design

The system interface was designed to facilitate user interaction with the application. Wireframes were used as preliminary designs to display the layout of menus, input forms, student data pages, and report pages accessible to teachers and parents. The wireframe design was kept simple, intuitive, and consistent so that it could be easily used by users with varying levels of digital literacy.

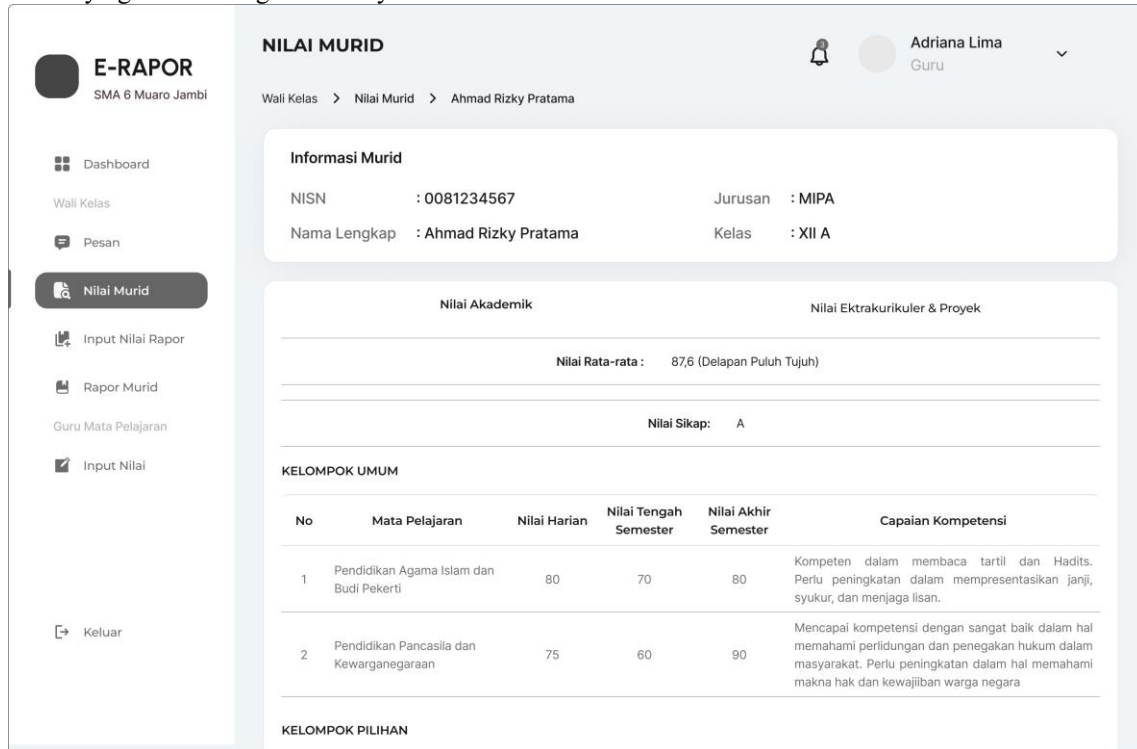


Fig. 5 Sampel Wireframe

Next, a prototype was developed from the wireframe to illustrate a more realistic view of the system. This prototype contains visual elements such as authentication forms, teacher dashboards, grade input pages, and digital report cards that can be downloaded or printed. The prototype was also used to conduct usability testing prior to system implementation, so that the interface could be tailored to user needs.

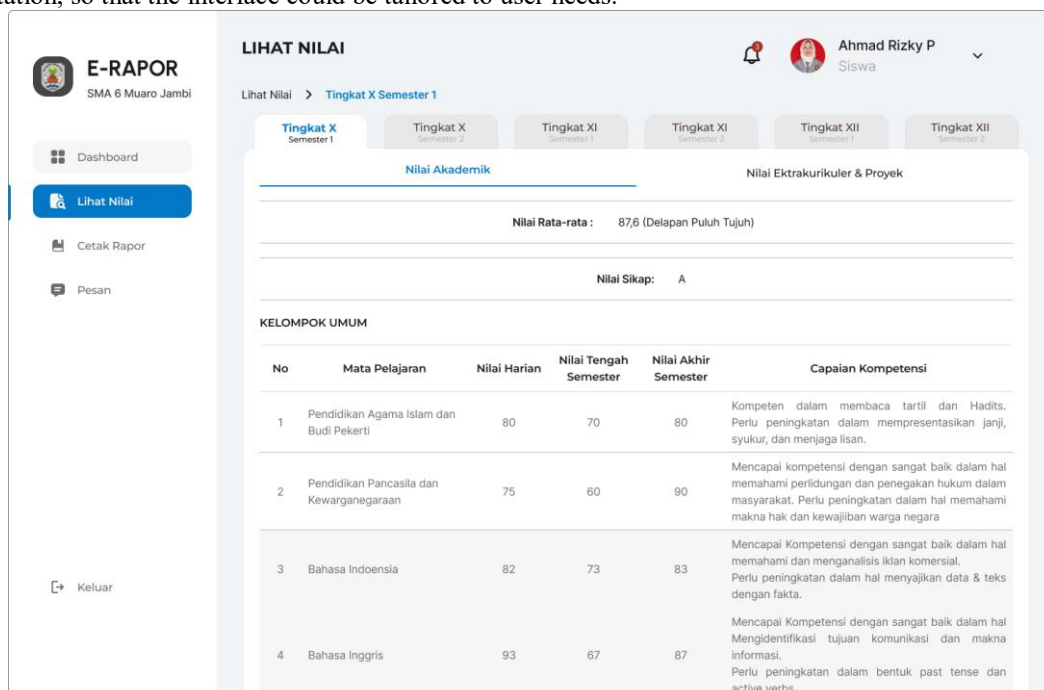


Fig. 6 Student Report/Grade Page

The "View Grades" page displays students' academic and non-academic information. On this page, students/parents can also view their academic grades, including previous report cards, which can be selected at the top of the page. This page displays academic grades, including a list of subjects, daily grades, midterm grades, final grades, and competency achievements. It also displays the student's average grade and attitude.

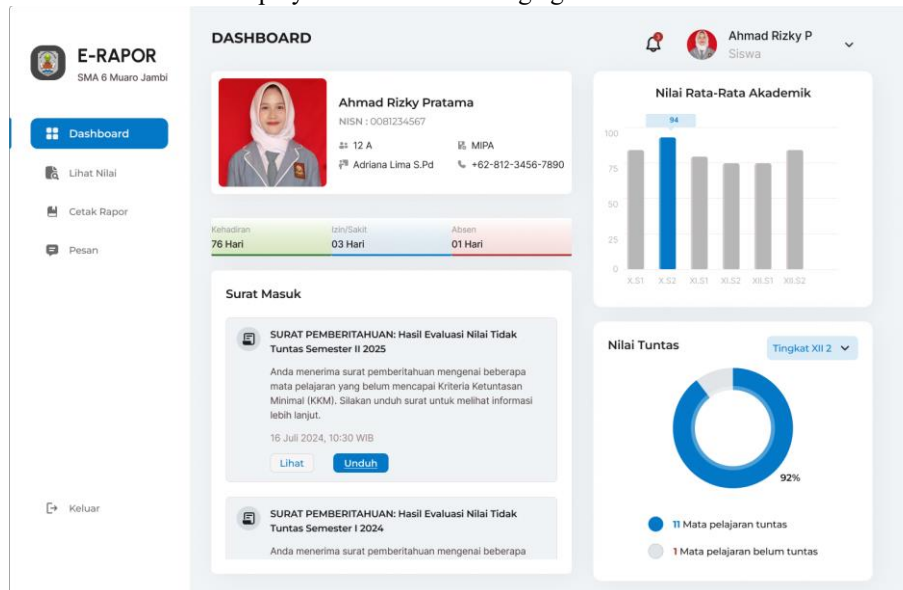


Fig. 7 Student/Parent Dashboard Page

Page In the student or parent role, the wireframe is designed with four main menus, namely 'Dashboard', 'View Grades', 'Print Report Card', and 'Messages'. The 'Dashboard' menu displays a summary of important information related to student data. The 'View Grades' menu is divided into two parts, namely academic grades and extracurricular grades, so that users can monitor student progress comprehensively. Furthermore, the 'Print Report Card' menu is provided to facilitate printing report cards in a format that meets school standards. The 'Messages' menu is used as a means of communication between students or parents and homeroom teachers. Student/Parent Dashboard

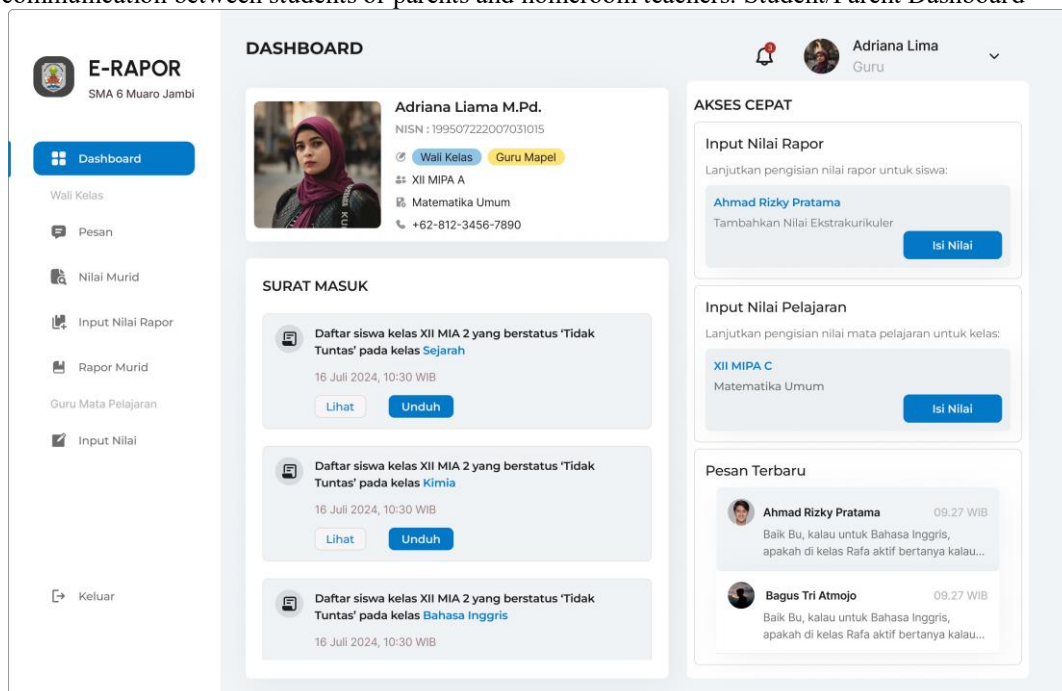


Fig. 8 Teacher Dshboard Page

Teacher roles in the e-report system are divided into two: subject teachers and homeroom teachers. The difference between the two lies in the scope of access to available features. Subject teachers can only use the 'Dashboard' and 'Input Grades' menus for the subjects they teach. Meanwhile, homeroom teachers have broader access,

including the 'Dashboard' menu, 'Messages' to parents in the class they supervise, 'Student Grades' to view student grades entered by subject teachers, 'Input Report Grades' to input extracurricular grades, Pancasila projects, and student attitude grades, 'Student Reports' to view and download the final report results for each student, and 'Input Grades' according to the subjects taught. The login method remains the same, namely by using the NIP and password provided by the school, but differences in access rights are determined by the teacher's role recorded in the system.

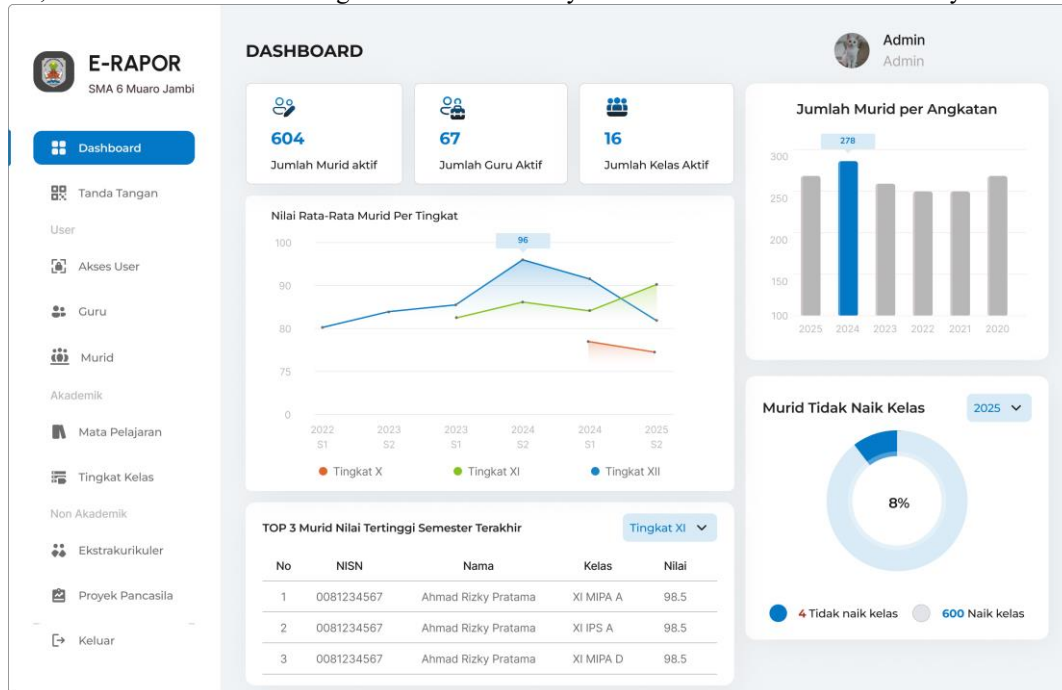


Fig. 9 Admin Dashboard Page

The admin role in the E-Rapor system manages core data through the Create, Read, Update, and Delete (CRUD) process. In addition, the admin is also responsible for adding electronic signatures from the principal and homeroom teacher as part of report card validation. Admins can access features such as the 'Dashboard', 'Signature', 'User Access', 'Teacher', 'Students', 'Subjects', 'Grade Level', 'Extracurricular Activities', and 'Pancasila Project' menus.

Evaluation Stage

The evaluation stage was carried out by testing the developed prototype to evaluate the user experience and ease of interaction with the interface. The testing was conducted using the Maze tool and produced a MAUS score. The prototypes tested were the Student/Parent, Homeroom Teacher, and Subject Teacher prototypes. Each role was represented by five respondents with the following scores:

Table 2. Score MAUS Result

No	Role	Task Scenario	Score MAUS
1	Murid/Orang Tua	6	93
2	Wali Kelas	8	74
3	Guru Mapel	4	67

DISCUSSION

The results of the study show that the development of a web-based E-Report system at SMAN 6 Muaro Jambi has successfully addressed the main problems in manual report processing, such as the potential for errors in recording grades, the risk of data loss, and limited access for parents to their children's academic progress. Through the application of the Structured System Analysis and Design (SSAD) method, this study produced a system design integrated with data flow modeling (DFD), database design (ERD), and interface design in the form of wireframes and prototypes. This system is designed to support grade input, data recapitulation, student progress monitoring, and digital report card distribution that can be accessed in real-time by teachers, students, and parents.

Evaluation of the system through usability testing using Maze shows varying levels of effectiveness of use between user roles. Students/parents obtained the highest score (93), indicating ease of access to information on grades and report cards. Homeroom teachers obtained a score of 74, while subject teachers only obtained 67, indicating the need for improvement in the aspects of grade input and system navigation. These findings prove that the system prototype has been able to meet the needs of grade management digitization, although improvements are still needed in

terms of the interface and the work efficiency of teachers and homeroom teachers. Thus, this study has produced a web-based E-Report card system design that will be more effective, transparent, and support the efficiency of academic management in schools.

CONCLUSION

The conclusion of this study is that the design of a web-based E-Report card system at SMAN 6 Muaro Jambi using the Structured System Analysis and Design (SSAD) method is able to provide a solution to the problem of manual report card management by presenting a more structured, secure, and efficient system. This study contributes to providing a data flow model, database design, and interface prototype that can improve transparency and accessibility of academic information for teachers, students, and parents. However, the limitation of this study lies in the scope of evaluation, which is still limited to a prototype, so further development is needed in order to be implemented in schools.

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