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Web-Based Student Achievement Management System Using Student Performance Indicators

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Abstract - The management of student achievement and talent data in schools is still commonly conducted manually, resulting in data inconsistencies, duplication, and difficulties in accessing information. In addition, student performance evaluation is often carried out subjectively due to the absence of structured assessment indicators. This golf of this project is to create a web-based student achievement and talent management system to support student performance evaluation. The Laravel framework and MySQL database werw used in the waterfall approach of system development. The research involved system testing through Black Box Testing, GTmetrix, performance testing, and User Acceptance Testing (UAT) conducted with users of the system. To improve the objectivity of student evaluation, the system applies Student Performance Indicators (SPI) covering academic, achievement, and student activity aspects. The outcomes demonstrate the system's ability to managing student data in an integrated manner, facilitating information access, and supporting more objective performance evaluation. The developed system can assist schools in improving the effectiveness of student achievement management and evaluation processes.

Keywords - Student Achievement, Student Performance, Information System, Performance Indicators.

I. INTRODUCTION

Vocational High Schools, commonly referred to as Sekolah Menengah Kejuruan (SMK), have an important role in preparing students with academic competencies, practical skills, and non-academic abilities that are aligned with industrial and societal demands. In the educational environment, student achievements and talents are considered important indicators that can support the evaluation of student performance and school development [1], [2]. At SMK Negeri 1 Talamau, student achievement and talent data are still managed manually through spreadsheets and paper-based records. This condition often causes data duplication, recording errors, difficulties in retrieving information, and inefficient reporting processes [3].

In addition to data management problems, the evaluation of student performance is generally carried out subjectively because it is not yet supported by structured and measurable indicators. Most assessments tend to focus only on academic scores without considering other aspects such as non-academic achievements, organizational participation, and student activities. As a result, schools face difficulties in monitoring student development comprehensively and objectively [4].

Several previous studies have developed web-based academic information systems and student management systems to improve the efficiency of educational data processin ing. Nevertheless, most of these studies mainly emphasized administrative management and did not integrate a structured student performance evaluation mechanism based on measurable indicators. Therefore, there is still a need for an integrated system that not only manages student achievement data but also supports objective student performance assessment through performance indicators [5].

To overcome these problems, this study proposes the development of a web-based Student Achievement and Talent Management System. The system was selected because it can simplify data processing activities, improve information accessibility, and support more effective student performance evaluation. In this study, the Key Performance Indicator (KPI) concept is adapted into Student Performance Indicators (SPI), which assess students based on several aspects, including academic performance, achievements, organizational participation, and student activities using a weighted evaluation mechanism. Compared to previous systems that mainly focused on basic administrative processing, the proposed approach offers a more comprehensive and structured evaluation process [6], [7].

In addition to managing achievement data, the proposed system also provides notification features that support student performance improvement. Through the SPI mechanism, the system can identify areas of student performance that still require improvement and provide recommendations based on students' achievements and activities. This feature enables students to obtain information regarding aspects that need to be improved, thereby encouraging learning motivation, self-development, and active participation in both academic and non-academic activities [8].

The proposed system is expected to improve the effectiveness and objectivity of student performance evaluation in schools. Furthermore, the system is expected to assist schools in managing student achievement and talent data in a more integrated, efficient, and accessible manner. Based on these objectives, this study aims to design and develop a web-

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based Student Achievement and Talent Management System using the Laravel framework and MySQL database to support integrated student performance evaluation in Vocational High Schools.

II. METHODS

The method applied in this study is the Waterfall model, which is one of the approaches within SDLC or System Development Life Cycle. This model is a structured software development approach that follows a step-by-step and sequential process. There are several stages in the development process, including requirement analysis, system design, implementation, and testing [9].

The development process is divided by the waterfall method, before going on to the next stage each one must be finished. This ensures that the development process is carried out in an orderly and controlled manner. This method was selected because it provides a clear approach and work well with systems that have specific requirements from the beginning. As a result, the system development process can be executed more systematically and is expected to produce an optimal outcome [10].

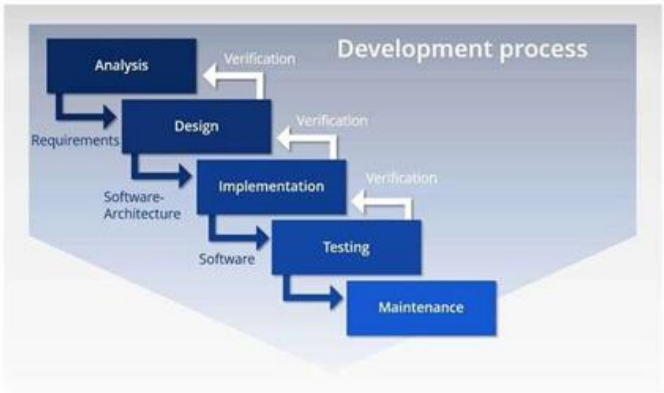

Figure 1. Waterfall Method

A. *Analysis*

System analysis is a stage carried out to examine the system thoroughly in order to identify and evaluate existing problems. This process is conducted through observation and interviews to obtain data that will be used as the basis for system design[11].

1. System Requirements

System requirements describe the essential specifications needed to support system development and operation. In this study, Functional requirements, non-functional requirements, and supporting hardware and software requirements are the three categories of system requirements[12].

a. Functional Requirements

The essential services that the system must offer in order to satisfy user needs are defined by functional requirement. The system is designed to support student achievement management, including user authentication for different roles such as administrators, teachers, and students. The system also provides functionality for managing student data, recording academic and non-academic achievements, overseeing organizational operations and evaluating student performance. In addition, the system is able to generate final scores and ranking results based on predefined assessment criteria.

b. Non-Functional Requirements

Non-functional requirements describe the quality attributes of the system that ensure its usability and reliability. The system is required to have a user-friendly interface to support ease of use for all users. It must also provide fast processing performance, secure authentication mechanisms, and web-based accessibility. Furthermore, the system should be reliable during operation and maintainable to support future development and improvement.

c. Hardware and Software Requirements

To support system development and implementation, appropriate hardware and software resources are required. The minimum hardware specification includes a computer or laptop with at least an Intel i3 processor, 4 GB RAM, and sufficient storage capacity, along with a stable internet connection. On the software side, PHP is the programming language used in the system's development and MySQL as the database management system. The development environment uses XAMPP as a local server, while system testing and access are performed using standard web browsers such as Google Chrome or Mozilla Firefox.

B. *Design*

The collected data is used in the system design process by applying modeling techniques such as Unified Modeling Language (UML). This stage aims to describe the system workflow, data structure, and interactions between users within the system[13], [14].

1. Use Case Diagram

Using a Use Case Diagram, the system's functionality and the relationship between actors and the system [10], [15].

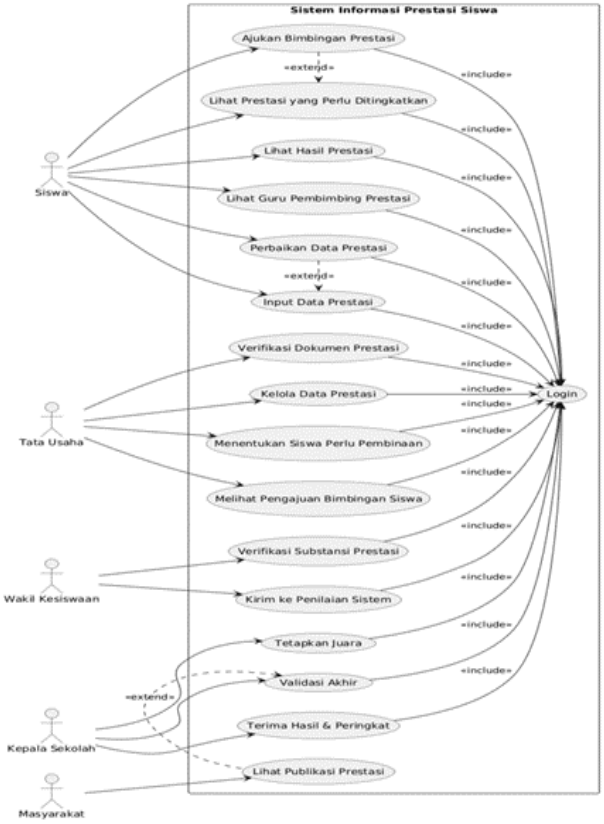

Figure 2. Use Case Diagram

2. Activity Diagram

An Activity Diagram is one of the UML models used to describe the sequence of system activities. This diagram illustrates the sequence of processes from beginning to end and describes user interactions in a structured manner [16].

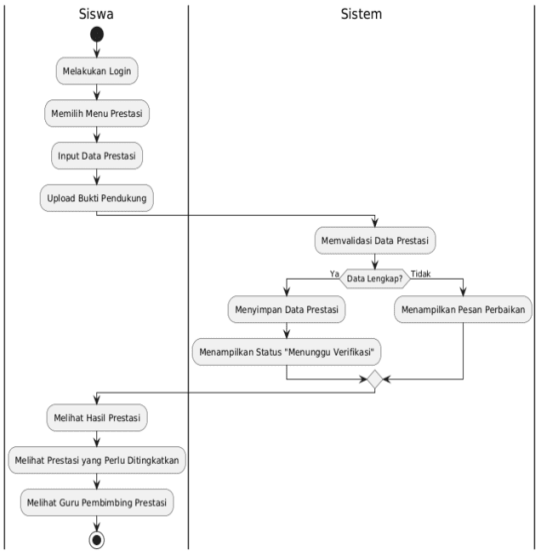

Figure 3. Student Activity Diagram

Figure 3. Student Activity Diagram illustrates the workflow of students within the system, starting from login, entering achievement data, updating data, and viewing achievement results and progress.

3. Sequence Diagram

A UML model called a sequence diagram is used to show interactions between objects and the communication flow that within a system. This diagram shows the order of messages exchanged between objects during a process[17].

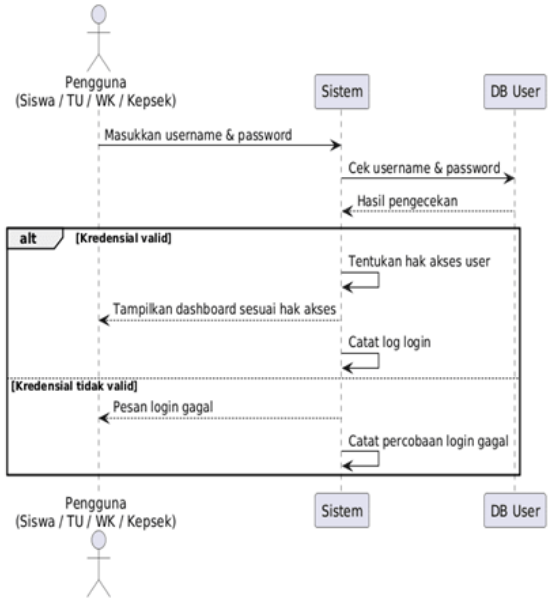

Figure 4. Login Sequence Diagram

Figure 4 illustrates the user authentication process involving students, administrative staff, student affairs officers, and the principal. The system validates user credentials and displays the dashboard based on user access rights or shows an error message if the login process fails.

4. Class Diagram

A Class Diagram show how a system is structured according to organise based on classes, attributes, and the relationships between classes within the system [18].

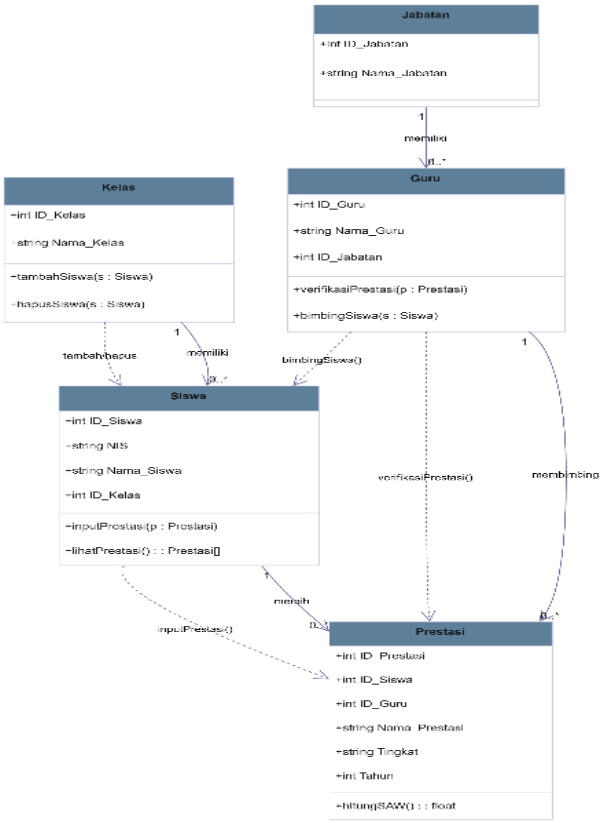

Figure 5. Class Diagram

Figure 5 shows the relationships between classes such as classes, positions, teachers, students, and achievements that are interconnected in supporting the management of student achievement data.

5. Entity Relationship Diagram

A model used to show the connections between data entities in a database is called an entity relationship diagram, or ERD [19].

Figure 6. Entity Relationship Diagram

Figure 6 shows that the ERD consists of several entities, including Students, Classes, Achievements, Teachers, and Positions, which are interconnected to support integrated management of student achievement data.

C. Implementation

1. System Implementation

At the implementation stage, the system design was translated into a functional software application through the coding process. PHP (version 8.x) and the Laravel framework (version 10) were used in the system's development, while MySQL was used as the database management system to store and manage all system data, including student information and performance records.

The development environment was supported by Laragon as a local server platform and Visual Studio Code (VS Code) as the primary code editor. This combination provided an efficient environment for development, debugging, and testing throughout the implementation process.

The implementation was carried out incrementally, starting from a local development environment (localhost). Each system module, including authentication, data management, and KPI-based evaluation, was tested individually to ensure correct functionality before integration into the complete system. After all components were verified, the system was prepared for further testing and deployment.

2. Implementation of KPI and SPI

The system applies a performance evaluation model based on Key Performance Indicator (KPI) and Student Performance Index (SPI) to measure student achievement in a structured and objective manner. The evaluation uses four indicators: academic performance, report score, non-academic achievement, and organizational activity.

Each indicator is assigned an equal weight of 0.25 to ensure fairness in evaluation. This approach follows the principles of Multi-Criteria Decision Making (MCDM), where all criteria are treated equally to avoid bias in decision-making [20]. The final score is calculated using the following formula:

$$Final\ Score = (Academic \times 0.2 + (Report \times 0.25 + (NonAcademic \times 0.25) + (Organization \times 0.25) \quad (1)$$

The evaluation process includes data collection, normalization, weighting, aggregation, and ranking based on the final score.

D. Testing

The implemented system was evaluated to determine whether all features functioned according to the designed requirements. In this research, the evaluation process applied the User Acceptance Test (UAT) method, which focuses on measuring user responses toward the system in terms of usability, functionality, and user satisfaction [21].

The testing process was conducted by distributing questionnaires to system users. The questionnaire used a Likert scale with five point: Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree. The responses collected from users were then processed to calculate the feasibility percentage of the system [1].

The following formula is used to calculate the percentage score:

$$P = \frac{\sum R}{N} \text{ x } 100\% \quad (2)$$

Description:

P = Percentage score
∑R = Total score obtained from respondents
N = Maximum ideal score

After the percentage value was obtained, the system feasibility level was classified based on predetermined assessment criteria are presented shown in the following table 1.

Table 1. System Feasibility Standars

No	Percentage Level	Criteria
1	81% – 100%	Extremely
2	61% – 80%	Feasible
3	41% – 60%	Reasonably
4	21% – 40%	Less Feasible
5	< 21%	Unfeasible

E. Maintenance

The maintenance phase is performed after the system has been deployed to ensure that all features continue to run properly. This stage involves monitoring system performance, correcting possible errors, and updating the system based on user feedback and operational needs. Maintenance activities are necessary to keep the system stable, secure, and able to support long-term use effectively.

III. RESULT AND DISCUSSION

Based on the waterfall model's phases system analysis, system design, implementation, and system testing this section offers the findings and analysis of the created system, and system performance evaluation. The results are structured to reflect each phase of the development process in a systematic manner.

A. System Analysis Results

The analysis phase identified several issues in the previous manual system used for managing student achievement data. The main problems included decentralized data storage, difficulties in retrieving student records, and the absence of an integrated system for performance management.

These results led to the proposal of a web-based system to centralize data management and automate the recording of student achievements. The proposed system aims to improve efficiency, accuracy, and accessibility of student performance data.

B. System Design Results

The study's findings demonstrate web-based system for managing student performance and achievements that consists of several interconnected components. The system is designed to support the administration of student data, achievement document, and related information in a more organized and accessible way for users.

1) Main Dashboard Page

Figure 7. Main Dashboard Page

As shown in Figure 7, the main dashboard server as the initial interface of the system, providing users with access to key features such as the homepage, system advantages, achievement publications, and gallery. This section also includes a login feature that directs authorized users to the internal system. The page functions as the primary access point for users to access information and services within the system.

2) Login Page

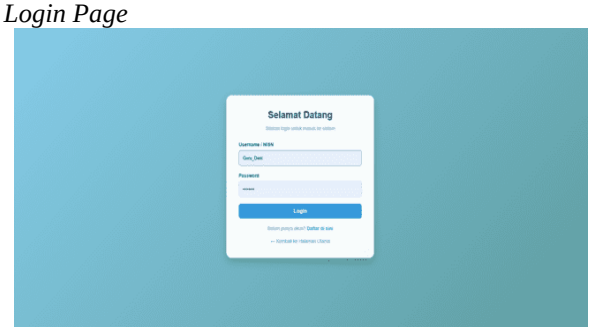

Figure 8. Login Page

Figure 8 illustrates that the login page functions as an access gateway for users who have authorized credentials to enter the system.

3) Admin Dashboard Page

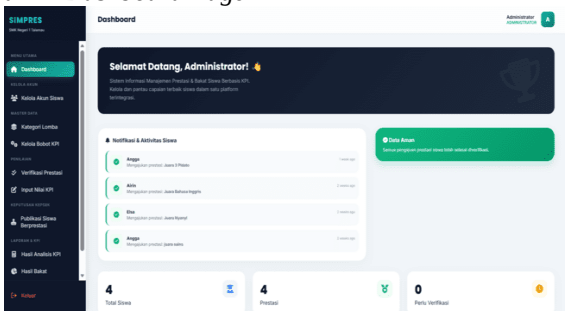

Figure 9. Admin Dashboard Page

The admin dashboard is shown in figure 9, which function as the main central control panel for managing all system.

4) Input Data Page

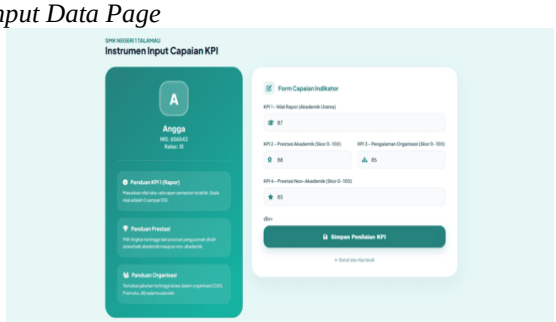

Figure 10. Input Data Page

As shown in figure 10, the data input page is used to add student achievement data into the system. This page allows users to enter and store performance data directly into the system database.

C. Implementation Results

MySQL was used as the database management system and PHP as the programming language for the system's implementation. Development was conducted in a local environment using Laragon and Visual Studio Code before deployment and testing.

The implementation results indicate that all system modules function properly, including authentication, data management, and KPI-based performance evaluation. The system operates according to the designed specifications.

D. System Testing Results

User Acceptance Testing (UAT) was used to test the system by distributing questionnaires to users. The assessment focused on several aspects, including functionality, usability, appearance, and ease of system access. The questionnaire result from respondents were then calculated using the percentage formula as follow:

Where:

$$P = \frac{\sum R}{N} \text{ x } 100\%$$

System testing was carried out by the *User Acceptance Testing* (UAT) approach by distributing questionnaires to 55 respondents. The evaluation covered three main aspects: usability, functionality, and interface design.

Table 2I. UAT Results

No	Assessment Aspect	Maximum Score	Obtained Score
1.	Usability	750	640
2.	Functionality	1000	860
3.	Interface Design	750	650
	Total	2500	2150

Based on Table II, the total score obtained from the respondents was 2150 out of a maximum score of 2500. The percentage result was calculated using the following formula:

$$P = \frac{\sum R}{N} \times 100\%$$

$$P = \frac{2150}{2500} \times 100\%$$

$$P = 86\%$$

The calculation result shows that the system achieved a score of 86%, which indicates that the system is suitable for supporting student achievement and performance management activities.

E. System Performance Evaluation

System performance evaluation was conducted to assess the application's performance in real usage conditions. The results indicate that the system performs well in terms of response time, data processing, stability, and resource usage.

The system is able to handle user requests such as login, data input, and KPI-based calculations efficiently without significant delays. The performance of the KPI calculation process is also consistent and produces results quickly.

In addition, the system remains stable during simultaneous user access without errors or system crashes. From a resource perspective, the application is lightweight since it is developed using PHP and MySQL, allowing it to run on standard server specifications. Overall, the evaluation shows that the system has good performance, is stable, and is suitable for use.

IV. DISCUSSION

The results of this study not only reflect system testing outcomes but also describe how the system operates in the context of educational information management. The role-based access design for administrators, teachers, and students reflects the concept of information systems with controlled access, ensuring data security and restricting users to relevant information according to their roles.

From a theoretical perspective, the system aligns with the concept of integrated educational information systems, which utilize centralized digital platforms to improve efficiency, accuracy, and data accessibility. In addition, the system also functions as a decision-support tool that promotes more objective evaluation in educational environments.

Compared to previous studies, web-based academic systems have been proven to improve data management efficiency and reduce errors in manual processes. This study extends previous work by introducing a KPI and SPI-based evaluation model, which provides a more structured, measurable, and objective approach to assessing student performance.

The implementation of KPI and SPI also offers advantages over conventional assessment methods by applying equal weighting to all indicators. This approach reduces bias and produces a more balanced evaluation between academic and non-academic aspects.

From an educational impact perspective, the system improves transparency in student assessment, accelerates access to achievement data, and supports data-driven decision-making. This helps teachers and schools monitor student development more effectively, while also providing students with clearer insights into their performance progress.

Based on the feasibility percentage calculation, the system achieved a score of 86%, which indicates that the developed system is categorized as very feasible and suitable for supporting student achievement management and performance evaluation activities in schools[22].

V. CONCLUSION

This study develops a web-based student achievement system with a primary focus on supporting student performance evaluation. The system improves the efficiency and accuracy of student data processing, replacing manual recording methods that often lead to duplication and inconsistencies. The system evaluation using User Acceptance Testing (UAT) involving 55 respondents produced a feasibility score of 86%, indicating that the system is well accepted and suitable for supporting structured student performance evaluation in schools.

This research contributes to the development of a more structured student evaluation model through the implementation of the Key Performance Indicator (KPI) approach, adapted into the Student Performance Index (SPI). This model provides a more objective and measurable framework for evaluating student performance by combining academic achievement, non-academic activities, organizational involvement, and report-based assessment into a single evaluation system. In the context of student performance evaluation, the system improves consistency, transparency, and standardization of assessment results. It reduces subjectivity in evaluating students and ensures that performance measurement is based on clear and balanced indicators.

Although the system has been successfully implemented, it still has limitations in handling advanced performance analysis. The current evaluation process is still based on fixed indicators and does not yet adapt dynamically to changes in student performance trends. Future development should focus on enhancing the evaluation model by introducing adaptive performance assessment, predictive analysis of student achievement, and data-driven evaluation recommendations to improve the accuracy and effectiveness of student performance measurement.

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