Research Article

Decision Support System for Selection of High-Aching Students Using Simple Additive Weighting Method

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Abstract: Determination of outstanding students is done manually and tends to be subjective. This has shortcomings that cause several problems, namely, it takes a long time and requires energy for manual data processing, then requires extra care and thought in processing student value data. This study aims to produce a decision support system for selecting outstanding students with a matrix normalization process to a scale that can be compared with all existing alternative ratings using ISO 25010 with 8 testing aspects. This development uses the Waterfall model with research steps, namely: 1) Requirement, 2) Design, 3) Implementation, 4) Verification, and 5) Maintenance. In the early stages, researchers seek information related to user needs for the system to be created. Furthermore, the media design is designed based on the results of the needs analysis, after which the media is developed. The final stage is testing. Data collection instruments are conducted through Observation, interviews, and questionnaires. The data analysis technique used is based on the 8 testing characteristics in ISO 25010. The results of the functional suitability aspect test with a result of 98.6% of the criteria "Very Eligible". Performance efficiency testing with a result of 85.2% of the category grade B which is categorized as "Good". Usability testing of the percentage of user responses with a result of 84% of the criteria "Very Good". The results of the compatibility test show that the system has been successfully run on several versions of the browser well and does not cause problems when accessing the system. The results of the security test show that the system has good security with a grade of B. Based on these data, it can be concluded that the system that has been developed has successfully met 8 aspects of testing using ISO 25010.

Keywords: decision support system, simple additive weighting, student value data, normalization, student selection

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1. Introduction

Student achievement serves as significant evidence of an educational institution's success. Within a high-achieving educational setting, "*berprestasi*" (achieving) signifies that students are pupils who consistently adhere to the rules and regulations established by the school or their teachers, and who always take responsibility for their duties as students. According to Laila (2021), high-achieving students are those who can attain accomplishments exceeding the established standards, both academically and non-academically. There are two types of abilities that students must possess in the learning process: technical skills and knowledge (hard skills), and the ability to manage oneself and others (Sari & Oktafianto, 2017).

Determining high-achieving students is not solely based on their subject grades; rather, a student's capabilities also constitute an assessment factor in determining whether or not they are eligible to be considered a high-achieving student. Each year, schools invariably select high-achieving students to receive appreciation for their learning outcomes.

This provision of appreciation can enhance the motivation or desire to learn among students. However, the process of determining high-achieving students conducted by the school is often manual and tends to be subjective, as it primarily focuses on students' academic grades. Consequently, the resulting decisions may not be fair to other students who meet the standards in non-academic areas.

Manually determining high-achieving students presents several drawbacks, leading to the following issues: It is a time-consuming process requiring significant effort for manual data processing, and it demands meticulousness and extra cognitive effort to process student grade data. These challenges can impact school policy regarding the selection of students eligible to be recognized as high-achieving. The manual selection process has several weaknesses, including the potential for errors in assessment, subjective decision-making, and considerable time investment, particularly given the large volume of data to be processed, which can occasionally result in human error.

Based on the aforementioned issues, one viable alternative to assist schools in determining high-achieving students is to leverage advancements in information technology, specifically by utilizing decision support system technology. A decision support system is a system capable of providing the ability to solve problems or the capacity to facilitate communication regarding semi-structured and unstructured problems.

The Simple Additive Weighting (SAW) method is a technique employed in decision support systems. This method is commonly referred to as the weighted sum method. The Simple Additive Weighting (SAW) method is widely used in research to address various problems (A. A. Gumay, et.al., 2024), (M. M. Putri., et.al., 2024), (H. Aulawi., et.al., 2023), (M. Fatkhudin, et.al., 2023).

(A. T. Muharram, et.al., 2022), (A. P. Kirana, et.al, 2023).. This method can calculate different values based on predefined criteria and weights. Sulistiyo (2018) states that the SAW method offers advantages in accommodating diverse types of criteria, flexibility in determining criteria weights, and the ability to provide consistent and objective solutions. (Hartatik., et.al., 2022), (G. T. Pranoto., et.al., 2022). SAW is an effective method for selecting the best alternative in various applications, such as investment decision-making and the selection of top employees (Sudipa et al., 2023).

Therefore, the objective of this research is to develop a decision support system as a solution to assist the UPT SMAN 3 Pinrang in determining high-achieving students. The decision support system implemented in this study utilizes the Simple Additive Weighting (SAW) method. It is anticipated that this decision support system for determining high-achieving students will aid and streamline the process for UPT SMAN 3 Pinrang in processing student grades to identify high-achieving students. Furthermore, with this decision support system, the selection process for high-achieving students at SMA Negeri 3 Pinrang can be conducted more effectively and efficiently, while also reducing assessment errors and subjective decision-making. Additionally, the DSS can expedite the selection process and save time for the UPT SMAN 3 Pinrang.

2. Literature Review

The Decision Support System is supported by several vital and essential components consisting of an understanding of the Information System, Outstanding Student, Decision Support System, and software [Graphical User Interface and Database Connectivity], as well as other components, the description is as follows: [1] Information Systems: An information system is a system within an organization that integrates the need for managing daily transactions, supports operations, serves managerial functions, and facilitates strategic activities. It also provides relevant external parties with the necessary reports (Dewi et al., 2021). [2] Outstanding Students: According to Azami (2023), a student

is an individual undergoing a developmental or growth process based on their natural disposition, requiring consistent guidance and direction to reach their optimal potential. Achievement is defined as the outcome attained by an individual through the execution of specific activities. Alawiyah (2019) further explains that academic achievement can be categorized into five aspects: intellectual ability, cognitive strategies, verbal information, attitudes, and skills.

[3] Decision Support System: A Decision Support System (DSS) is a computer-based system used by managers or groups of managers at various organizational levels to assist in decision-making for solving semi-structured problems (Wahono & Ali, 2021). [4] Simple Additive Weighting Method: The Simple Additive Weighting (SAW) method requires the normalization of a decision matrix (X) into a comparable scale across all alternative ratings. It is one of the most widely known and commonly used methods in situations involving Multiple Attribute Decision Making (MADM). MADM itself is a method used to identify the optimal alternative from several options based on specific criteria (Zain & Purniawati, 2020). [5] HTML: According to Roberto Kaban and David JM Sembiring (2021), HTML (Hypertext Markup Language) is a language used to write web pages. It is a programming language designed to structure documents and implement the concept of hypertext within a web environment.

Moreover, [6] MySQL: MySQL is a system used to manage collections of data structures (databases), including both creation and administration processes. It is a software or database system that maintains relational data types to manage and store data efficiently (Pratiwi et al., 2020). [7] XAMPP: XAMPP is software used to run PHP-based websites and MySQL data processing on a local computer. It is often referred to as a virtual server control panel, which allows users to preview and modify websites without requiring an online or network connection. XAMPP is commonly used for testing websites or applications before deploying them to a remote web server (Firdaus, 2022). [8] PHP: According to Winanjar and Susanti (2021), PHP is a server-side scripting language commonly used to develop dynamic web applications. And [9] ISO 25010: ISO 25010, developed by the International Organization for Standardization, is part of the ISO 25000 series of standards. This series is designed to establish a framework for evaluating the quality of software products.

3. Method

The research method used in this study is Research and Development (R&D), which focuses on developing a decision support system for selecting outstanding students at UPT SMAN 3 Pinrang. According to Sugiyono (2016), the R&D method is defined as a scientific approach to researching, designing, producing, and testing the validity of the developed product. This study employs the Waterfall development model, which includes the following stages: 1. Requirement, 2. Design, 3. Implementation, 4. Verification, and 5. Maintenance. Furthermore, The following outlines the design process of the Decision Support System for Selecting Outstanding Students at SMAN 3 Pinrang. The design model applied in this study is the Waterfall model:

1. Requirement

This stage involved identifying user needs related to the system to be developed. The information was gathered through direct observation and interviews with the principal and students of SMAN 3 Pinrang.

2. Design

The design phase aims to provide a comprehensive overview of what needs to be developed. It includes creating models for system input, processes, and output using Unified Modeling Language (UML) as well as designing the user interface of the system.

3. Implementation

The implementation phase involves programming. The programming language used was PHP, with Laragon for database management. The framework used was Laravel, and the code editor utilized was Adobe Dreamweaver.

4. Verification

The verification process is needed to see the accuracy of the results of the selection process, verification is also carried out by testing the software or GUI by users to ensure how satisfied the user is, and also the process of documenting the test results, to see how much the percentage of user-friendliness is from the results of user assessment.

5. Maintenance

System maintenance is needed to maintain performance, improve the performance of verification results, fix bugs, and also update the assessment criteria. Figure 1 is the Waterfall Method used in this research.

Figure 1. Waterfall Method used in this research

4. Result and Discussion

4.1 Website Design

Figure 2 shows the admin login page, where the administrator can enter a pre-registered username and password to access the next page of the system.

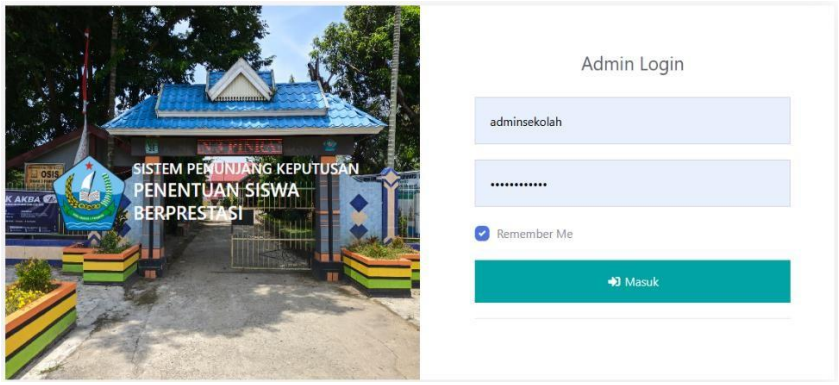

Figure 2. Website Display of Admin Login section

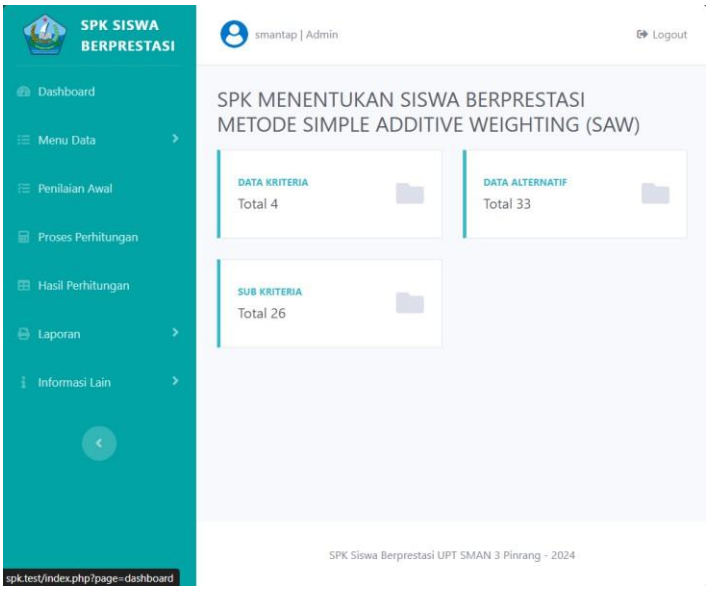

Figure 3. Main Page or Admin Dashboard

Figure 3 shows the admin dashboard, which is the main page displayed after successfully logging into the system. This page serves as a control center that provides access to various features and important information.

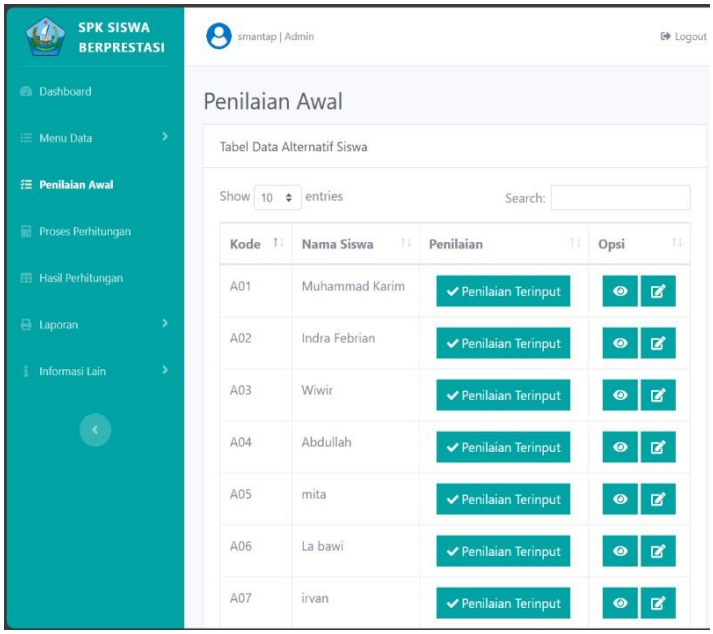

Figure 4. Initial assessment page

Moreover, Figure 4 is an initial assessment menu that displays the assessment data table, where if the admin has input student assessment data, the input results will appear in the initial assessment menu.

4.2 System Testing

4.2.1 Functional suitability

Table 1. Functional Suitability of System Performance

Feature	Validator 1 Score	Validator 2 Score	Total
Home Page			
Login menu	1	1	2
Login button	1	1	2
Dashboard page (Admin)			
Admin dashboard page	1	1	2
Data Menu	1	1	2
Criteria Data Menu	6	6	12
Alternative Data Menu	6	6	12
Sub Criteria Menu	1	1	2
Initial Assessment Menu	4	3	7
Calculation Process Menu	3	3	6
Report Menu	1	1	2
Normalization Print Menu	2	2	4
Print Ranking Menu	2	2	4
Other information menu	3	3	6
Total Score Obtained			**73**
Expected Score Amount			**74**
Assessment Percentage			**98,6%**
Category: Valid			

Table 1 shows the overall Functional Stability of the system performance. The researcher's system testing stage uses ISO 25010 with 8 testing aspects, namely functional suitability, performance efficiency, compatibility, usability, reliability, security, maintainability, and portability. The system's feasibility percentage from a functionality perspective falls under the "*Very Feasible*" criteria because its feasibility percentage is greater than 81%.

4.2.2 Performance Efficiency

Based on the performance efficiency testing results, the average percentage score obtained is 85.2%, falling into Grade B. Therefore, it can be concluded that the system is considered good in terms of efficiency and quality.

4.2.3 Compatibility

The test results show that the Decision Support System for the Selection of Outstanding Students at SMAN 3 Pinrang is compatible with Edge version 127, Firefox version 128, Safari version 17, Opera version 111, Chrome version 127, iOS versions 16-17, and Android version 120. It can be concluded that the system successfully runs on several browser versions without causing any issues when accessing the system.

4.2.4 Usability

Based on the calculation, the percentage of user response to the system is 84%. This percentage of respondents can be converted to qualitative data, with the system criteria being "*Very Good*" because the user response percentage falls within the range of 81-100%. Therefore, the system can be said to have met the usability aspect.

4.2.5 Reliability

Based on the calculation results, the system obtained a reliability score of 1 or 100%. This means that out of the 5000 requests successfully executed, the system experienced no failures whatsoever. Therefore, it can be concluded that the system is considered reliable because it achieved a test result with a percentage of 100%, and the system testing is declared to have met the reliability aspect.

5. Conclusion

The system built in this research shows a test result that shows a very good value that reaches 98.6% of the functional suitability level, and also from the system value achieved is 73 points, this is a good result. For the testing team, two independent validators were tasked with evaluating various features in the system built, starting from the main page, login menu, and other specific menus such as criteria management, calculations, and reporting systems. The criteria data menu and alternative data menu features received the highest scores (12 points each), indicating that the core components of the Simple Additive Weighting method function very well. The only scoring discrepancy occurred in the Initial Assessment menu, where Validator 1 gave a score of 4 while Validator two gave a score of three, which may indicate an area that could still be improved. The results of the final category are "*valid*" which shows the decision-making system for selecting outstanding students is successfully implemented and used, with a high level of accuracy.

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