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A Decision Support System for the Selection of Outstanding Students Using the SAW (Simple Additive Weighting) Method at SMA Negeri 1 Padang

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ABSTRACT

The selection of outstanding students is an important process in educational institutions to recognize academic and non-academic achievements. However, the process is often carried out subjectively and lacks a systematic approach, which can lead to less accurate and inconsistent results. This study aims to develop a Decision Support System (DSS) using the Simple Additive Weighting (SAW) method to assist in selecting outstanding students at SMA Negeri 1 Padang. The SAW method is applied to evaluate multiple criteria, including academic performance, extracurricular activities, attendance, behavior, and achievements. Each criterion is assigned a weight based on its level of importance, and the alternatives (students) are ranked according to the final score obtained from the SAW calculation. The results of this study indicate that the proposed system is capable of providing objective, transparent, and efficient recommendations in determining outstanding students. The implementation of the DSS is expected to support decision-makers in producing fair and accurate selections

Keyword : Decision Support System, SAW, Outstanding Students, Multi-Criteria Decision Making, Education.

1. Introduction

The advancement of information technology has significantly influenced various sectors, including education. Schools are increasingly required to adopt technological solutions to improve efficiency, accuracy, and transparency in decision-making processes. One important decision-making activity in schools is the selection of outstanding students, which aims to recognize and reward students with excellent academic and non-academic achievements. At SMA Negeri 1 Padang, the selection of outstanding students is typically based on several criteria, such as academic performance, extracurricular involvement, attendance, behavior, and achievements. However, the current selection process is often conducted manually, which can lead to subjectivity, inconsistency, and inefficiency. As a result, the final decision may not fully reflect the overall performance of students in a fair and objective manner. To address these issues, a systematic and structured approach is needed to support

decision-making. A Decision Support System (DSS) can be utilized to assist decision-makers in evaluating multiple criteria and alternatives more effectively. DSS is designed to process data and provide recommendations based on specific methods or models, thereby improving the quality of decisions. One of the methods that can be applied in a DSS is the Simple Additive Weighting (SAW) method. The SAW method is a widely used technique in multi-criteria decision-making due to its simplicity and ability to produce accurate rankings. This method works by normalizing the decision matrix and calculating a weighted sum of each alternative based on predefined criteria. Therefore, this study aims to develop a Decision Support System using the SAW method to support the selection of outstanding students at SMA Negeri 1 Padang. The proposed system is expected to provide a more objective, transparent, and efficient selection process, as well as assist school management in making fair and accurate decisions.

2. Research Methods

2.1 Research Design

This study uses a quantitative approach to develop a Decision Support System (DSS) using the Simple Additive Weighting (SAW) method.

2.2 Data Collection Methods

Data were collected from SMA Negeri 1 Padang using three techniques: observation, interviews, and documentation.

1. Observation

The implementation of the Decision Support System (DSS) using the Simple Additive Weighting (SAW) method at SMA Negeri 1 Padang demonstrates several key strengths. The system effectively handles multiple criteria simultaneously, including academic performance, extracurricular activities, attendance, behavior, and economic background, by normalizing diverse data scales to enable objective comparison.

The calculation results show that students with consistently strong performance across these criteria receive higher preference values, reflecting a comprehensive assessment of overall merit. Importantly, factoring in economic criteria such as parents' income adds fairness, particularly for scholarship or outstanding student selections.

By converting complex, multi-criteria data into a clear ranking, the SAW method streamlines the decision-making process. It also reduces subjectivity compared to manual evaluations, since all candidates are assessed based on predetermined weights and criteria.

In summary, this DSS improves efficiency, transparency, and objectivity in selecting outstanding students, making it a valuable tool for school administrators and decision-makers.

2. Interview

To support the data collection process, interviews were conducted with teachers and school administrators at SMA Negeri 1 Padang to gather detailed insights into the current selection process for outstanding students, the criteria applied, and challenges encountered during decision-making.

The interviews revealed that the selection process is still conducted manually, primarily based on evaluating academic performance, extracurricular activities, attendance, and behavior. However, this manual approach tends to be subjective, relying heavily on individual judgment without a standardized calculation method, which can result in inconsistencies in the final decisions.

Respondents also highlighted difficulties in distinguishing the most deserving student when multiple candidates exhibit similar performance levels. Additionally, the lack of a computerized system makes the process time-consuming and less efficient.

Consequently, the implementation of a Decision Support System using the SAW method is seen as essential to facilitate more objective student evaluations. Respondents indicated that such a system would enhance accuracy, transparency, and fairness in selecting outstanding students at SMA Negeri 1 Padang.

3. Documentation

The documentation method was employed to collect supporting data related to the selection of outstanding students at SMA Negeri 1 Padang. This data was sourced from official school records and relevant documents reflecting students' performance and eligibility. Key documents included academic transcripts, attendance records, extracurricular activity reports, and student achievement certificates.

Additionally, the documentation encompassed administrative data such as student identity, class information, and parents' income records, which are essential for assessing economic criteria. These data served as the primary input for the Decision Support System, ensuring the evaluation process relies on accurate and valid information.

The collected documentation was systematically organized and processed according to the criteria established in the SAW method. This approach guarantees that all data utilized in the analysis is reliable and supports objective decision-making. Overall, the documentation method plays a vital role in providing comprehensive and well-structured data for the effective implementation of the system.

2.3. Criteria and Alternative

The alternatives in this study are students eligible to be selected as outstanding students. The evaluation criteria are:

1. C1: Academic Performance
2. C2: Extracurricular Activities
3. C3: Attendance
4. C4: Behavior
5. C5: Economic Background (Parent's Income)

Each criterion was assigned a weight according to its level of importance determined by the school/experts. The total weight is normalized so that:

$$\sum_{j=1}^{n} w_j = 1$$

2.4 Simple Additive Weighting (SAW) Method

The SAW method is used to rank alternatives by computing a weighted sum of normalized criterion values. The main steps are as follows:

1. Constructing the Decision Matrix
   The first step is to construct a decision matrix X=[xij]X = [x_{ij}]X=[xij], where xijx_{ij}xij represents the performance value of alternative AiA_iAi on criterion CjC_jCj.

2. Normalization of the Decision Matrix
   The normalization process is performed to transform various criterion values into comparable scales. The normalization formulas are:
   For benefit criteria:

$$r_{ij} = \frac{x_{ij}}{\max(x_{ij})}$$

   For cost criteria:

$$r_{ij} = \frac{\min(x_{ij})}{x_{ij}}$$

3. Determining Criteria Weights
   wj such that ∑wj=1\sum w_j = 1∑wj=1.
4. Calculating the Preference Value
   The preference value ViV_iVi for each alternative is calculated using the formula:

$$V_i = \sum_{j=1}^{n} w_j \cdot r_{ij}$$

5. Rank alternatives
   based on ViV_iVi from the highest to the lowest value. The highest ViV_iVi indicates the most suitable student candidate.

Table 2.1 rank alternativ

No	Student`s Name	academic score (C1)	Extracurricular (C2)	Attendance (C3)	Attitude (C4)	Income (C5)	Scholarship
1	Andi	95	80	95	88	2.000.000	Not Worth it
2	Wahyudi	90	79	90	85	5.000.000	Not Worth it
3	Tasya	95	89	96	88	1.500.000	Worth it
4	Hera	90	81	90	85	2.000.000	Not Worth it
5	Sakinah	94	83	90	88	3.000.000	Not Worth it

Based on the collected data, the maximum and minimum values for each criterion are determined as part of the normalization process. For benefit criteria, the maximum value is used, while for cost criteria, the minimum value is considered. The results are as follows: the maximum value of academic performance (C1) is 95, extracurricular activities (C2) is 89, attendance (C3) is 96, and behavior (C4) is 88. Meanwhile, for the income criterion (C5), which is categorized as a cost criterion, the minimum value obtained is 1,500,000.

Table 2.2 criteria

Name	C1	C2	C3	C4	C5
Andi	100%	89.89%	98.96%	100%	75%
Wahyudi	94.74%	88.76%	93.75%	96.59%	30%
Tasya	100%	100%	100%	100%	100%

Hera	94.74%	91.01%	93.75%	96.59%	75%
Sakinah	98.95%	93.26%	93.75%	100%	50%

1. Divide the Value by the Maximum Value (Benefit)
2. Reverse the income because the cost is min/income
3. Then multiply by 100% to get a percentage

.

3. Results and Discussions

The content shows facts/data. Can use tables and numbers but not repeat the same data in pictures, tables, and text. Subtitles can be used to further clarify the description.

Discussion is the basic explanation, relationship, and generalization demonstrated by the results. The description answers a research question. If there are dubious results, point them out objectively.

3.1 Results

The implementation of the Decision Support System (DSS) using the Simple Additive Weighting (SAW) method at SMA Negeri 1 Padang generated a ranking of students based on multiple evaluation criteria, including academic performance, extracurricular activities, attendance, behavior, and parents' income as an economic factor.

The data underwent normalization to convert all criteria values into comparable scales, followed by weighted calculations to reflect the relative importance of each criterion in the decision-making process. The results reveal that students with consistently high scores across most criteria received higher preference values.

Among the candidates, Tasya achieved the highest score due to her excellent performance in all criteria combined with the lowest income level, making her the most eligible candidate. Andi and Sakinah followed with relatively high scores, though slightly lower in some criteria. Meanwhile, Hera and Wahyudi ranked lower due to moderate performance and higher income levels, which impacted their overall standing.

Overall, these results demonstrate that the SAW method effectively produces a clear and objective ranking of students. The system successfully identifies the most qualified candidates by integrating academic, behavioral, and economic factors, thereby supporting accurate and fair decision-making.

3.2 Discussions

The results of this study demonstrate that applying the Simple Additive Weighting (SAW) method within a Decision Support System offers an effective approach for selecting outstanding students at SMA Negeri 1 Padang. By incorporating multiple criteria—academic performance, extracurricular activities, attendance, behavior, and economic background—the system evaluates students comprehensively and objectively.

The normalization process is essential for fairly comparing criteria with different measurement scales, while weighted values enable decision-makers to prioritize criteria based on their significance. This ensures that the final ranking reflects both academic excellence and other important factors.

The findings show that students with consistently strong performance across most criteria achieve higher preference values. For example, Tasya ranks highest due to balanced excellence across all aspects, whereas students with lower performance in specific criteria receive correspondingly lower

rankings. This highlights the SAW method's ability to differentiate effectively among candidates, even when their differences are subtle.

Compared to conventional manual selection, the proposed system reduces subjectivity and enhances transparency by basing decisions on clear calculations and predefined criteria. However, the results are still affected by weight assignments, which could introduce bias if not carefully determined.

In summary, the discussion confirms that the SAW-based DSS is a reliable tool for supporting decision-making in selecting outstanding students. It improves efficiency while ensuring fairness and consistency in evaluations. Future enhancements might include integrating additional decision-making methods for comparison and expanding the system with more diverse data inputs..

4. Conclusion

This study successfully developed a Decision Support System (DSS) for selecting outstanding students at SMA Negeri 1 Padang using the Simple Additive Weighting (SAW) method. The system efficiently processes multiple criteria—such as academic performance, extracurricular activities, attendance, behavior, and economic background—in a structured and systematic way. By implementing the SAW method, the system objectively evaluates all alternatives through normalization and weighted calculations, producing a clear ranking of students. The results demonstrate that this system enhances accuracy, transparency, and efficiency compared to the traditional manual selection process. Thus, the developed DSS serves as an effective tool to assist decision-makers in selecting outstanding students fairly and reliably. Future enhancements may include expanding the criteria, incorporating additional data sources, and integrating the system into web or mobile platforms to increase accessibility and usability.

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