

Comparison Analysis of the SAW and TOPSIS Methods in Determining the Best Teacher (Case Study at SMK Swasta PABAKU Stabat)

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Submitted : 20 September 2024 | **Accepted** : 12 Oktober 2024 | **Published** : 1 November 2024

Abstract: This study compares the Simple Additive Weighting (SAW) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) methods for determining the best teacher at SMK Swasta PABAKU Stabat. Teacher data was collected from 19 individuals via observation, interviews, and literature review. The web-based decision support system built successfully integrated SAW and TOPSIS to select the top teacher. SAW produced rankings more aligned with manual rankings, boasting 53% accuracy, while TOPSIS yielded 32% accuracy. Additionally, SAW averaged a faster 0.10672 second execution time, contrasted to TOPSIS requiring 0.57004 seconds. Overall, this research offers meaningful insight into the effectiveness and efficiency of applying SAW and TOPSIS for best teacher selection. With superior accuracy and speed, SAW proves the more fitting and appropriate choice of the two methods.

Keywords: SAW Methods, TOPSIS Methods, Rapid Application Development (RAD), Decision Support System

INTRODUCTION

The quality of a nation's education is largely determined by the quality of its teachers. Teachers are the backbone of the educational system, acting as crucial components in determining the effectiveness of learning and directly influencing the outcomes of school graduates (Kholis et al., 2023). Their ability to inspire, engage, and educate students plays a significant role in shaping the future of individuals and, by extension, society as a whole (Noer & S.A.P, 2023). Therefore, improving teacher quality must be an ongoing effort (Rut Frida Hastuti Nduru & Nehemia Nome, 2023), as it is directly linked to the overall enhancement of educational quality. Without adequately prepared and motivated educators, even the best curricula and resources may fail to yield the desired results.

One effective approach to enhancing teacher quality is through systematic performance evaluations and the provision of rewards by the school (Al Maktoum & Al Kaabi, 2024). These evaluations serve not only as a means of assessing teachers' effectiveness but also as a motivational tool. By recognizing and rewarding exceptional performance, schools can encourage teachers to continuously strive for excellence in their teaching practices. This recognition can manifest in various forms, including bonuses, promotions, professional development opportunities, and public acknowledgment of achievements (Rhinesmith et al., 2023). Such incentives can significantly motivate teachers to improve their performance and adopt innovative teaching strategies, ultimately benefiting their students (Hao, 2023).

However, the process of determining which teachers are outstanding is not a straightforward task. It involves a complex array of criteria that must be considered objectively, such as attendance, discipline, teaching ability, and professional conduct (Finefter-Rosenbluh & Power, 2023). Each of these factors plays a vital role in evaluating a teacher's overall effectiveness and impact on students. For instance, consistent attendance is essential, as it reflects a teacher's commitment and reliability (Finch et al., 2023; Taylor & Charlebois, 2024). Similarly, discipline in the classroom is crucial for maintaining an environment conducive to learning. Teaching ability, which encompasses pedagogical skills and subject knowledge, directly affects student engagement and understanding. Finally, a teacher's professional conduct, including their interactions with colleagues, students, and parents, influences the overall school climate.

Given the multifaceted nature of this evaluation process, a decision support system is essential to assist schools in fairly and accurately assessing and selecting the best teachers based on predetermined criteria (Sabharwal & Miah, 2024). A robust decision support system can help streamline the evaluation process, ensuring that it is not only fair but also systematic (Wang et al., 2023). Several commonly used decision support system methods include Simple Additive Weighting (SAW) (Pradipta, 2024; Supriyadi, 2024; Tjahja et al., 2023) and Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) (Iskandar, 2023; Singgalen, 2023). Each of these methods has its strengths and weaknesses, making them suitable for different contexts and requirements.

The SAW method is often praised for its simplicity and ease of use. However, it is sensitive to changes in criteria weights, which can lead to significant variations in the final rankings of teachers. On the other hand, the TOPSIS method takes into account the distance to an ideal solution (Farid & Hadikurniawati, 2023), allowing for a more nuanced analysis of alternatives. While TOPSIS may provide more accurate results, it is also more complex in its calculations, potentially requiring more resources and time for implementation (Wahyudi & Isnain, 2023). Previous studies have shown that while TOPSIS is generally more accurate than SAW, the latter is often more efficient in terms of computational requirements.

Based on these issues, this study aims to design and compare a decision support system for selecting the best teachers using both the SAW and TOPSIS methods. By implementing this system at SMK Swasta PABAKU Stabat, the study seeks to provide a practical framework for evaluating teacher performance. This system is expected to assist the school in evaluating teacher performance comprehensively and fairly, allowing for the identification of outstanding teachers according to the established criteria. The results of this comparative analysis are anticipated to provide insights into which method is more suitable for this specific teacher selection case, focusing on the perspectives of accuracy and computational efficiency. Ultimately, the findings aim to contribute to the broader goal of enhancing teacher quality and, consequently, the quality of education in the nation, ensuring that students receive the best possible instruction and support for their academic growth. This study employs the Rapid Application Development (RAD) system design methodology, facilitating a swift and efficient development process tailored to the needs of the educational context.

LITERATURE REVIEW

Simple Additive Weighting (SAW)

The Simple Additive Weighting (SAW) method is one of the simplest and most commonly used multi-attribute decision-making methods (Pradipta, 2024). The main principle of the SAW method is to calculate the weighted sum of performance ratings for each alternative across all criteria. In other words, the SAW method works by calculating the total weighted value of each alternative, considering the values of each criterion and the pre-defined weights, then ranking all alternatives based on their total scores.

The SAW method operates by summing the results of multiplying the decision matrix with the criteria weight vector. The total value obtained is then ranked to determine the best alternative. One advantage of the SAW method is its simplicity and ease of understanding. However, a drawback of this method is that it does not consider the correlation between criteria. The following are the steps or solution algorithms of the Simple Additive Weighting (SAW) method (Ciardiello & Genovese, 2023):

1. Determine the criteria or attributes used as benchmarks for solving the problem.
2. Normalize the values of each alternative for each criterion by calculating the performance rating value.

The formula used is as follows.

If j is a benefit criterion:

$$r_{ij} = \frac{x_{ij}}{\max_i x_{ij}} \quad (1)$$

If j is a cost criterion, then:

$$r_{ij} = \frac{\min_i x_{ij}}{x_{ij}} \quad (2)$$

Where:

- r_{ij} : Performance rating value
- x_{ij} : The value of alternative i in criterion j .
- $\max_i x_{ij}$: The maximum (largest) value of each criterion i
- $\min_i x_{ij}$: The minimum (smallest) value of each criterion i
- Benefit* : The type of criteria where the value the highest is the best
- Cost* : The type of criteria where the value the lowest is the one best

- Count mark weight preference for each alternative , with use formula following This .

$$V_i = \sum_{j=1}^n W_j r_{ij} \quad (3)$$

Where:

- V_i : Performance rating value
- w_j : The value of alternative i in criterion j .
- r_{ij} : The maximum (largest) value of each criterion i

- Do and determine ranking

Technique for Order Preference by Similarity to Ideal Solution (TOPSIS)

The TOPSIS method was first introduced by Yoon and Hwang in 1981. Basically, the TOPSIS method works by comparing a number of decision alternatives based on certain criteria to find the best alternative that has the closest distance to the positive ideal solution and the furthest from the negative ideal solution(Pandey et al., 2023). In simpler terms, the TOPSIS method seeks the best alternative solution from several choices by looking at its similarity to the ideal solution(Barman et al., 2024). A positive ideal solution is the best solution that can be obtained if all criteria are met, while a negative ideal solution is the worst solution. Therefore, this method selects the alternative that is closest to the positive ideal solution and furthest from the negative ideal solution.

The following are the steps or algorithm for solving the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method, namely as follows:

- Creating a normalized decision matrix

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}} \quad (4)$$

Where:

- With $i = 1, 2, \dots, m$; and $j = 1, 2, \dots, n$;
- r_{ij} : Decision matrix normalized.
- x_{ij} : Weight of the j th *criterion* on alternative i .
- i : Alternative to i .
- j : The j th *subcriterion* .

- Creating a weighted normalized decision matrix

$$y_{ij} = W_j r_{ij} \quad (5)$$

Where:

- With $i = 1, 2, \dots, m$; and $j = 1, 2, \dots, n$;
- w_j : Weight of the j th *criterion*

- Determining the positive ideal solution matrix and negative ideal solution matrix

$$A^+ = (y_1^+, y_2^+, \dots, y_n^+) \quad (6)$$

$$A^- = (y_1^-, y_2^-, \dots, y_n^-) \quad (7)$$

Where :

$$y_j^+ = \begin{cases} \max_i x_{ij}, & \text{if } j \text{ is benefit attribute} \\ \min_i x_{ij}, & \text{if } j \text{ is cost attribute} \end{cases}$$

$$y_j^- = \begin{cases} \min_i x_{ij}, & \text{if } j \text{ is benefit attribute} \\ \max_i x_{ij}, & \text{if } j \text{ is cost attribute} \end{cases}$$

- Calculate the distance between the value of each alternative with the positive ideal solution matrix and the negative ideal solution matrix.

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_j^+ - y_{ij})^2} \quad (8)$$

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_j^-)^2} \quad (9)$$

- Calculate the preference value (V_i) for each alternative.

$$V_i = \frac{D_i^-}{D_i^- + D_i^+} \quad (10)$$

METHOD

Research Flow

The research began by planning the requirements of the RAD (Rapid Application Development) method through data and information needs collection from SMK Swasta PABAKU Stabat, using observation and interviews. The collected data were used to identify the existing system and propose the development of a new system to address current weaknesses.

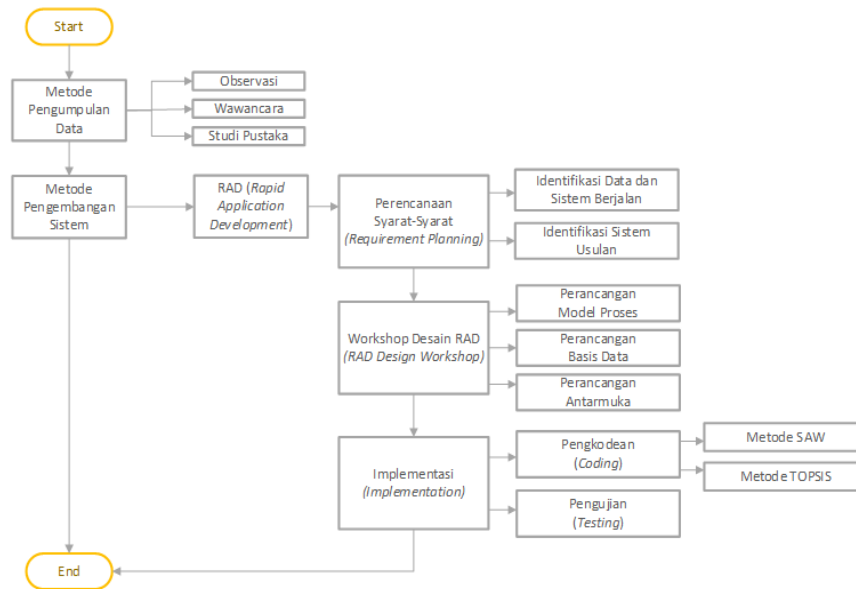


Figure 1. Research Flow

In the RAD workshop design phase (Meyliana et al., 2024), a model of the new system process was created using UML diagrams, a database, and an interface design. This design was then implemented in the coding phase using PHP programming language and MySQL database. The completed system was tested using blackbox testing to ensure it runs according to the specified workflow. The ultimate goal is to build a new system to replace the old one for determining the best teacher at the school. The sequence of the research process conducted is shown in Figure 1 below.

RAD DEVELOPMENT METHOD

The system development method that will be used in this study is Rapid Application Development (RAD). In short, RAD is a software development method that aims to shorten the processing time by actively involving users (Meyliana et al., 2024). In other words, RAD accelerates the system creation process by interacting and getting input from users continuously.

The main objective of implementing the RAD method in this study is to produce an information system that meets user needs more quickly and cost-effectively. With this method, it is expected that the system can be developed efficiently and effectively. The following is a cycle of the RAD (Riadi et al., 2024) development method which can be seen in Figure 2.

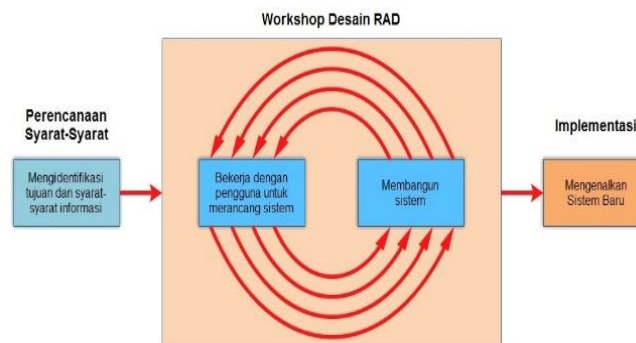


Figure 2. RAD cycle

Criteria

The following are the criteria that serve as a reference for selecting the best teacher candidates. Sixth criteria the can seen in table 1 below This . Criteria with weight evaluation highest is criteria Responsibility . Criteria used in study This determined directly by the party Head School .

Table 1. Assessment criteria

Criteria Code	Criteria Name	Attribute	Weight
C1	Attendance Rate	Benefits	0.1
C2	Attitude	Benefits	0.15
C3	Discipline	Benefits	0.15
C4	Ability Motivating Student	Benefits	0.1
C5	Responsibility	Benefits	0.3
C6	Ability in Teaching	Benefits	0.2

Sub Criteria

Next, the determination of the weight value is carried out for each previously determined criteria. Determination mark weight every criteria can seen in table 2 following :

Table 2. Sub Assessment Criteria

No	Criteria Name	Evaluation	Rating Range	Mark
1	Level Presence	Very less	1 – 20	1
		Not enough	21 – 40	2
		Enough	41 – 60	3
		Good	61 – 80	4
		Very good	81 - 100	5
2	Attitude	Very less	1 – 20	1
		Not enough	21 – 40	2
		Enough	41 – 60	3
		Good	61 – 80	4
		Very good	81 - 100	5
3	Discipline	Very less	1 – 20	1
		Not enough	21 – 40	2
		Enough	41 – 60	3
		Good	61 – 80	4
		Very good	81 - 100	5
4	Ability Motivating Student	Very less	1 – 20	1
		Not enough	21 – 40	2
		Enough	41 – 60	3
		Good	61 – 80	4
		Very good	81 - 100	5
5	Not quite enough Answer	Very less	1 – 20	1
		Not enough	21 – 40	2
		Enough	41 – 60	3
		Good	61 – 80	4
		Very good	81 - 100	5
6	Ability In Teach	Very less	1 – 20	1
		Not enough	21 – 40	2
		Enough	41 – 60	3
		Good	61 – 80	4
		Very good	81 - 100	5

Alternative Data

All data on the best prospective teachers at SMK Swasta PABAKU Stabat which is an alternative assessment is assessed based on research data in table 3 below.

Table 3. Alternative Data

No	Name	Criteria					
		C1	C2	C3	C4	C5	C6
1	AL	60	65	38	43	39	77
2	BS	78	56	69	85	60	36
3	DW	47	78	65	75	58	65
4	IN	86	83	81	74	60	78
5	EL	60	40	45	60	53	66
6	FS	75	38	73	82	57	60
7	MO	81	77	80	72	70	80
8	MDI	88	79	84	55	74	68
9	MHI	40	59	40	77	44	40
10	MUL	88	78	80	80	65	73
11	NA	80	86	78	88	80	82
12	NS	77	79	59	60	66	80
13	RS	85	80	79	58	60	81
14	SMN	80	83	60	75	60	83
15	SRM	69	60	58	78	53	60
16	SS	88	77	87	73	77	78
17	WY	80	80	75	59	63	79
18	WAL	68	73	76	47	61	77
19	YS	35	65	40	37	35	79

The value of alternative data each the best teacher candidate to become alternative evaluation determined through the results data research as listed above , then formed rating the compatibility listed below in table 4 .

Table 4 . Compatibility Rating

No	Name	Criteria					
		C1	C2	C3	C4	C5	C6
1	AL	3	4	2	3	2	4
2	BS	4	3	4	5	3	2
3	DW	3	4	4	4	3	4
4	IN	5	5	5	4	3	4
5	EL	3	2	3	3	3	4
6	FS	4	2	4	5	3	3
7	MO	5	4	4	4	4	4
8	MDI	5	4	5	3	4	4
9	MHI	2	3	2	4	3	2
10	MUL	5	4	4	4	4	4
11	NA	4	5	4	5	4	5
12	NS	4	4	3	3	4	4
13	RS	5	4	4	3	3	5
14	SMN	4	5	3	4	3	5
15	SRM	4	3	3	4	3	3
16	SS	5	4	5	4	4	4
17	WY	4	4	4	3	4	4
18	WAL	4	4	4	3	4	4
19	YS	2	4	2	2	2	4

RESULT

SAW Method Calculation

1. Normalization

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In the calculation using the SAW method, the first step is to determine the criteria and alternatives to be used. Then, normalization is carried out on the decision matrix by calculating the normalized performance rating value (R_{ij}) of each alternative (A_i) on each criterion (C_j). If it is a benefit criterion, the X_{ij} value will be divided by the maximum X_{ij} value of each column, referring to formula 1. Meanwhile, if it is a cost criterion, the minimum X_{ij} value of each column will be divided by the X_{ij} value, following formula 2. The results of this normalization process can be seen in Table 5.

Table 5 . Matrix Normalization (R_{ij})

No	Name (A_i)	Criteria (C_i)					
		C1	C2	C3	C4	C5	C6
1	AL	0.6	0.8	0.4	0.6	0.5	0.8
2	BS	0.8	0.6	0.8	1	0.75	0.4
3	DW	0.6	0.8	0.8	0.8	0.75	0.8
4	IN	1	1	1	0.8	0.75	0.8
5	EL	0.6	0.4	0.6	0.6	0.75	0.8
6	FS	0.8	0.4	0.8	1	0.75	0.6
7	MO	1	0.8	0.8	0.8	1	0.8
8	MDI	1	0.8	1	0.6	1	0.8
9	MHI	0.4	0.6	0.4	0.8	0.75	0.4
10	MUL	1	0.8	0.8	0.8	1	0.8
11	NA	0.8	1	0.8	1	1	1
12	NS	0.8	0.8	0.6	0.6	1	0.8
13	RS	1	0.8	0.8	0.6	0.75	1
14	SMN	0.8	1	0.6	0.8	0.75	1
15	SRM	0.8	0.6	0.6	0.8	0.75	0.6
16	SS	1	0.8	1	0.8	1	0.8
17	WY	0.8	0.8	0.8	0.6	1	0.8
18	WAL	0.8	0.8	0.8	0.6	1	0.8
19	YS	0.4	0.8	0.4	0.4	0.5	0.8

2. Weight Multiplication

In this process, the normalized matrix is multiplied by the criteria weights as listed in Table 2. The results of multiplying the normalized matrix by the criteria weights can be seen in Table 6.

Table 6 . Weight Multiplication

No	Name (A_i)	Criteria (C_i)					
		C1	C2	C3	C4	C5	C6
1	AL	0.06	0.12	0.06	0.06	0.15	0.16
2	BS	0.08	0.09	0.12	0.1	0.225	0.08
3	DW	0.06	0.12	0.12	0.08	0.225	0.16
4	IN	0.1	0.15	0.15	0.08	0.225	0.16
5	EL	0.06	0.06	0.09	0.06	0.225	0.16
6	FS	0.08	0.06	0.12	0.1	0.225	0.12
7	MO	0.1	0.12	0.12	0.08	0.3	0.16
8	MDI	0.1	0.12	0.15	0.06	0.3	0.16
9	MHI	0.04	0.09	0.06	0.08	0.225	0.08
10	MUL	0.1	0.12	0.12	0.08	0.3	0.16
11	NA	0.08	0.15	0.12	0.1	0.3	0.2
12	NS	0.08	0.12	0.09	0.06	0.3	0.16
13	RS	0.1	0.12	0.12	0.06	0.225	0.2
14	SMN	0.08	0.15	0.09	0.08	0.225	0.2
15	SRM	0.08	0.09	0.09	0.08	0.225	0.12
16	SS	0.1	0.12	0.15	0.08	0.3	0.16
17	WY	0.08	0.12	0.12	0.06	0.3	0.16
18	WAL	0.08	0.12	0.12	0.06	0.3	0.16

19 YS 0.04 0.12 0.06 0.04 0.15 0.16

3. Preference Weight Value (Vi)

The preference weight value is obtained from the sum of the results of multiplying the normalized matrix row elements by their weights. The calculation results using the SAW method can be seen in Table 7. The values in Table 7 are calculated using formula 3.

Table 7 . SAW Method Preference Value

No	Name (Ai)	Weight Value Preferences (Vi)	Ranking
1	AL	0.61 0	17
2	BS	0.695	14
3	DW	0.765	12
4	IN	0.865	6
5	EL	0.655	16
6	FS	0.705	13
7	MO	0.88 0	4
8	MDI	0.89 0	3
9	MHI	0.575	18
10	MUL	0.88 0	5
11	NA	0.95 0	1
12	NS	0.81 0	11
13	RS	0.825	9
14	SMN	0.825	10
15	SRM	0.685	15
16	SS	0.91 0	2
17	WY	0.84 0	7
18	WAL	0.84 0	8
19	YS	0.57 0	19

TOPSIS Method Calculation

1. Normalization

After obtaining the preference value from the SAW method, the next step is to calculate the normalized decision matrix using the TOPSIS method, referring to formula 4. The following calculation results can be seen in table 8

Table 8 . Rij Normalization

Normalisation	Criteria (C _i)					
	C1	C2	C3	C4	C5	C6
R =	0.170	0.237	0.122	0.183	0.136	0.234
	0.226	0.177	0.245	0.304	0.204	0.117
	0.170	0.237	0.245	0.243	0.204	0.234
	0.283	0.296	0.306	0.243	0.204	0.234
	0.170	0.118	0.184	0.183	0.204	0.234
	0.226	0.118	0.245	0.304	0.204	0.175
	0.283	0.237	0.245	0.243	0.272	0.234
	0.283	0.237	0.306	0.183	0.272	0.234
	0.113	0.177	0.122	0.243	0.204	0.117
	0.283	0.237	0.245	0.243	0.272	0.234
	0.226	0.296	0.245	0.304	0.272	0.292
	0.226	0.237	0.184	0.183	0.272	0.234
	0.283	0.237	0.245	0.183	0.204	0.292
	0.226	0.296	0.184	0.243	0.204	0.292
	0.226	0.177	0.184	0.243	0.204	0.175
	0.283	0.237	0.306	0.243	0.272	0.234
	0.226	0.237	0.245	0.183	0.272	0.234

0.226	0.237	0.245	0.183	0.272	0.234
0.113	0.237	0.122	0.122	0.136	0.234

2. Weighted Normalized Decision Matrix

Furthermore that is multiply values in the R matrix with weight criteria . The results of the calculation of formula 5 the can seen in table 9.

Table 9 . Weighted Normalized Decision Matrix (Yij)

Normalisation	Criteria (C _i)					
	C1	C2	C3	C4	C5	C6
Y =	0.017	0.035	0.018	0.018	0.041	0.047
	0.023	0.027	0.037	0.030	0.061	0.023
	0.017	0.035	0.037	0.024	0.061	0.047
	0.028	0.044	0.046	0.024	0.061	0.047
	0.017	0.018	0.028	0.018	0.061	0.047
	0.023	0.018	0.037	0.030	0.061	0.035
	0.028	0.035	0.037	0.024	0.081	0.047
	0.028	0.035	0.046	0.018	0.081	0.047
	0.011	0.027	0.018	0.024	0.061	0.023
	0.028	0.035	0.037	0.024	0.081	0.047
	0.023	0.044	0.037	0.030	0.081	0.058
	0.023	0.035	0.028	0.018	0.081	0.047
	0.028	0.035	0.037	0.018	0.061	0.058
	0.023	0.044	0.028	0.024	0.061	0.058
	0.023	0.027	0.028	0.024	0.061	0.035
	0.028	0.035	0.046	0.024	0.081	0.047
	0.023	0.035	0.037	0.018	0.081	0.047
	0.023	0.035	0.037	0.018	0.081	0.047
0.011	0.035	0.018	0.012	0.041	0.047	

3. Positive and Negative Ideal Solutions

The positive ideal solution value and the negative ideal solution value from the TOPSIS method calculation according to formulas 6 and 7 can be found in Table 10 below.

Table 10 . Positive Ideal Solution (A+) and Negative (A-)

Ideal	Criteria (C _i)					
	C1	C2	C3	C4	C5	C6
A+	0.028	0.044	0.046	0.030	0.081	0.058
A-	0.011	0.018	0.018	0.012	0.041	0.023

4. Positive and Negative Ideal Distance

Table 11 shows the calculations of the positive and negative ideal distances generated based on the ideal solution values in Table 10. The values listed in Table 11 are results calculation use formula 8 and formula 9.

Table 11. Ideal Positive Distance (D+) and Negative (D-)

Positive Ideal Distance		Negative Ideal Distance	
D_1^+	0.054	D_1^-	0.030
D_2^+	0.046	D_2^-	0.036
D_3^+	0.030	D_3^-	0.042
D_4^+	0.024	D_4^-	0.054
D_5^+	0.043	D_5^-	0.033
D_6^+	0.042	D_6^-	0.037
D_7^+	0.018	D_7^-	0.057
D_8^+	0.019	D_8^-	0.060
D_9^+	0.055	D_9^-	0.025

D_{10}^+	0.018	D_{10}^-	0.057
D_{11}^+	0.011	D_{11}^-	0.066
D_{12}^+	0.027	D_{12}^-	0.053
D_{13}^+	0.027	D_{13}^-	0.051
D_{14}^+	0.029	D_{14}^-	0.052
D_{15}^+	0.041	D_{15}^-	0.031
D_{16}^+	0.016	D_{16}^-	0.061
D_{17}^+	0.022	D_{17}^-	0.055
D_{18}^+	0.022	D_{18}^-	0.055
D_{19}^+	0.057	D_{19}^-	0.029

5. Preference value

The final stage of the TOPSIS method is to calculate the choice value based on formula 10. The formula is the negative ideal distance divided by the sum of the negative ideal distance and the positive ideal solution distance. This calculation is carried out for each alternative candidate data as shown in Table 12.

Table 12 . TOPSIS Method Preference Value

No	Name (A _i)	Weight Value Preference (V _i)	Ranking
1	AL	0.361	17
2	BS	0.441	14
3	DW	0.588	12
4	IN	0.688	8
5	EL	0.435	15
6	FS	0.465	13
7	MO	0.758	4
8	MDI	0.759	3
9	MHI	0.315	19
10	MUL	0.758	5
11	NA	0.860	1
12	NS	0.660	9
13	RS	0.655	10
14	SMN	0.645	11
15	SRM	0.434	16
16	SS	0.793	2
17	WY	0.715	6
18	WAL	0.715	7
19	YS	0.340	18

Use Case Diagram

Use case diagram in Figure 3 shows the features that can be accessed by Admin and User in the decision support system for selecting the best teachers of SMK Swasta PABAKU Stabat. Admin can manage master data, enter teacher grades, view and print reports of calculation results of the method. While Users consisting of principals and teachers can only view and print the calculation results after logging into the system.

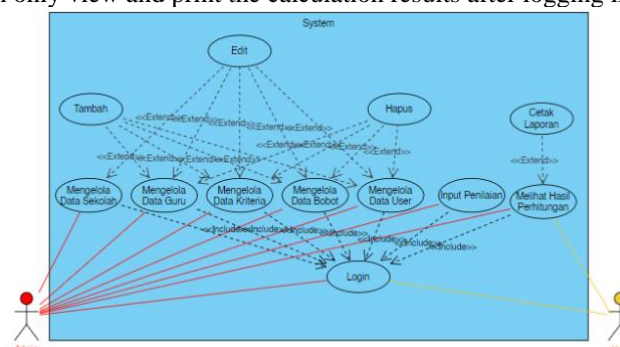


Figure 3. Use Case Diagram

Class Diagram

Below is a class diagram showing the structure of the system being built, as depicted in Figure 4.

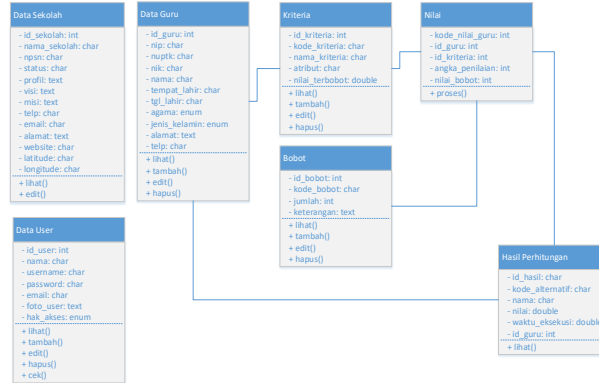


Figure 4. Class Diagram

Database Design

The following is a picture of the relationship between tables from the *database design* of the system being built.

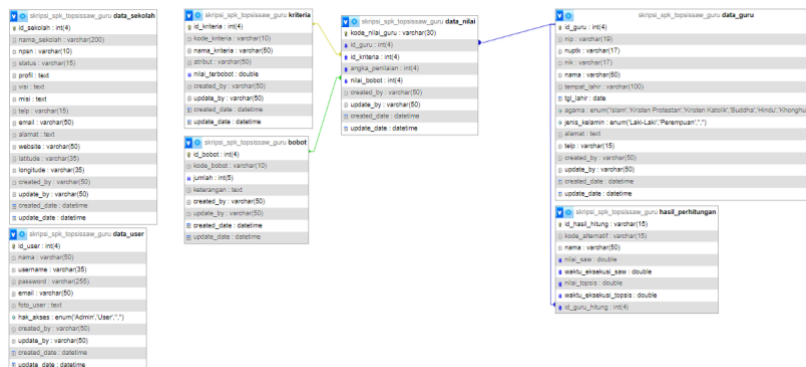


Figure 5. Relationships Between Tables

System Implementation

1. Admin

The following image shows the *Login page display* which functions to limit user access to view and interact with data in the system application.

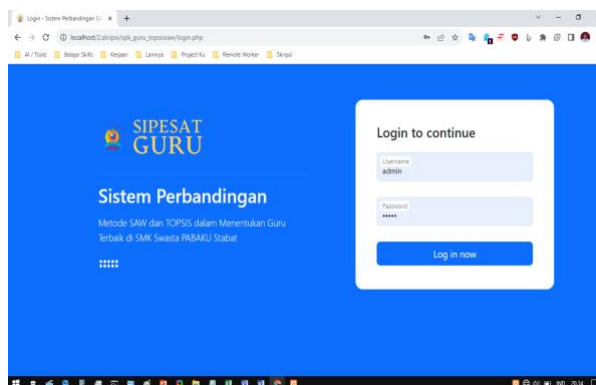


Figure 6. Login Page View

Dashboard Page Display functions to display the amount of data that has been entered into the system, such as school data, teachers, criteria, weights, and users. This page also provides a brief explanation of the application of this teacher selection decision support system.

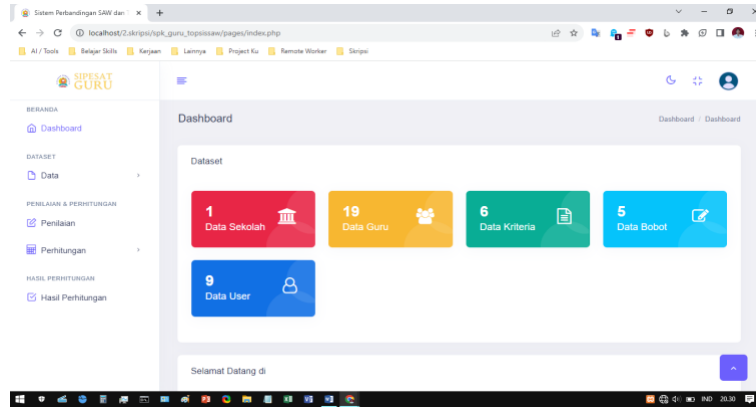


Figure 7. Dashboard Page View

The following image shows the SAW Method Calculation Page Display which functions to perform and display the calculation process using the Simple Additive Weighting (SAW) method.

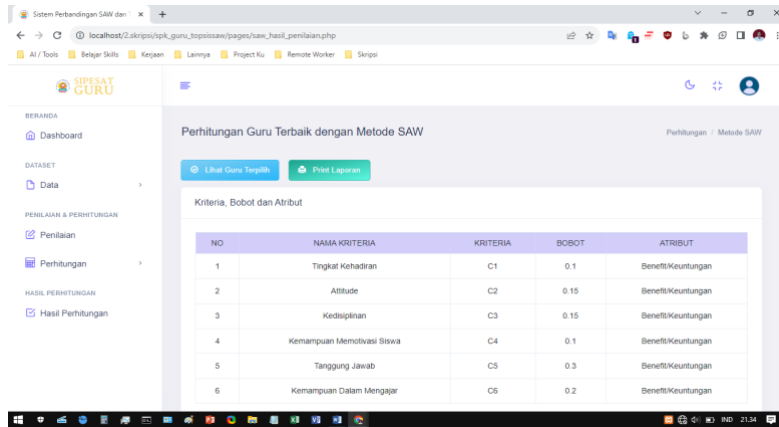


Figure 8. SAW Method Calculation Page View

Following image display TOPSIS Method Calculation Page interface that works For perform the calculation process with method *Technique for Order of Preference by Similarity to Ideal Solution* (TOPSIS).

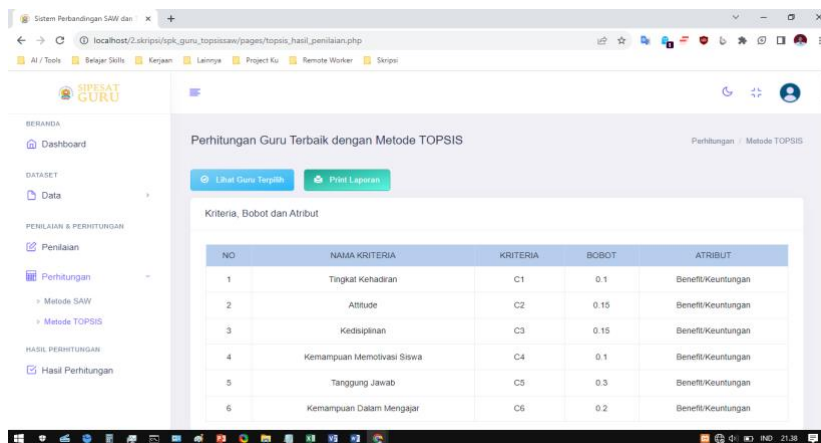


Figure 9. TOPSIS Method Calculation Page Display

2. User

The following is a display of the calculation results page using the SAW and TOPSIS methods of the system being built.

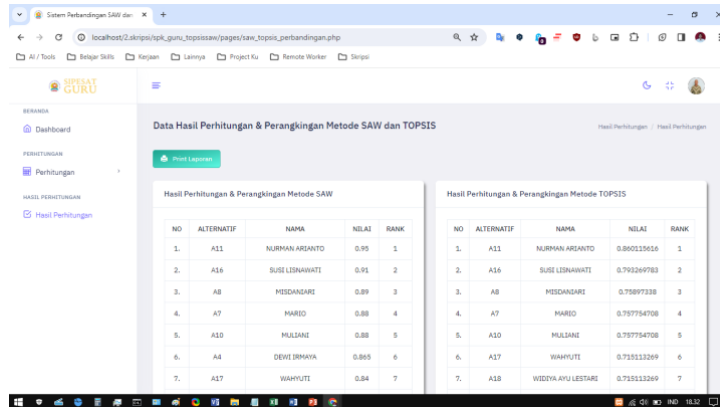


Figure 10. Display of the SAW and TOPSIS Method Calculation Results Page

The following is a display of the report print page used to print the calculation and ranking results sequentially using the SAW and TOPSIS methods.

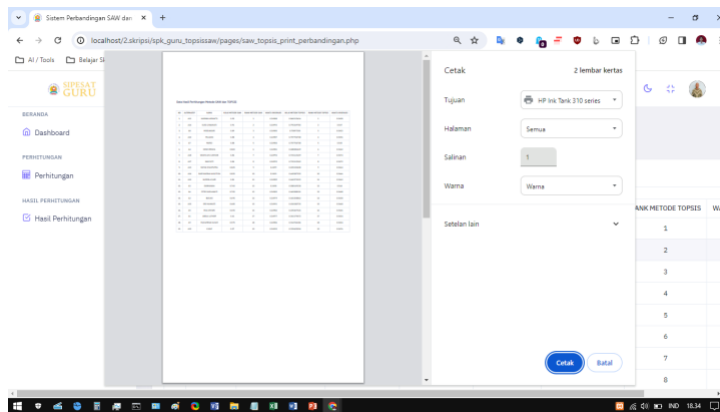


Figure 11. Print Report Page View

DISCUSSIONS

Testing of SAW and TOPSIS Methods

The following is a comparison of the final results of the calculations using the SAW method and the TOPSIS method to determine the nineteen best teacher candidates at SMK Swasta PABAKU Stabat.

Table 13 . Test Results

No	Name	SAW Method		Method TOPSIS		Method Manual	
		Mark	Rank	Mark	Rank	Mark	Rank
1	AL	0.610	17	0.361	17	53.67	17
2	BS	0.695	14	0.441	14	64.00	14
3	DW	0.765	12	0.588	12	64.67	12
4	IN	0.865	6	0.688	8	77.00	4
5	EL	0.655	16	0.435	15	54.00	16
6	FS	0.705	13	0.465	13	64.17	13
7	MO	0.880	4	0.758	4	76.67	5
8	MDI	0.890	3	0.759	3	74.67	6
9	MHI	0.575	18	0.315	19	50.00	18

10	MUL	0.880	5	0.758	5	77.33	3
11	NA	0.950	1	0.860	1	82.33	1
12	NS	0.810	11	0.660	9	70.17	10
13	RS	0.825	9	0.655	10	73.83	7
14	SMN	0.825	10	0.645	11	73.50	8
15	SRM	0.685	15	0.434	16	63.00	15
16	SS	0.910	2	0.793	2	80.00	2
17	WY	0.840	7	0.715	6	72.67	9
18	WAL	0.840	8	0.715	7	67.00	11
19	YS	0.570	19	0.340	18	48.50	19

Based on the test results in Table 13, a comparison was made between the calculation results with the SAW method, the TOPSIS method, and the manual method (without the decision support system method). From the comparison of the three methods, it was found that 10 out of 19 data were declared suitable when using the SAW method. Meanwhile, if using the TOPSIS method, only 6 out of 19 data were declared suitable.

1. Accuracy of SAW and TOPSIS Methods

$$\text{Accuracy} = \frac{\text{The number of data ranking similarities}}{\text{The amount of data}} \times 100\%$$

From the formula above we get:

$$\text{Accuracy of the SAW Method} = \frac{10}{19} \times 100\% = 53\%$$

$$\text{Accuracy of the TOPSIS Method} = \frac{6}{19} \times 100\% = 32\%$$

Based on Table 13, it is necessary to conduct an accuracy test to compare the SAW and TOPSIS methods. In the SAW method, there are 10 appropriate data, while in the TOPSIS method only 6 appropriate data. Referring to the accuracy calculation above, the SAW method has an accuracy of 53% and the TOPSIS method 32%.

The accuracy of the comparison results of these two methods is influenced by many factors, one of which is the conversion of scale values that can affect the difference in ranking and accuracy between the two methods. Judging from the results of testing with field data, the completion stages of the SAW method are more effective for use in the case of selecting the best teachers at SMK Swasta PABAKU Stabat compared to the TOPSIS method. This is indicated by the accuracy value of the SAW method which is higher than the TOPSIS method.

2. Execution Time of SAW and TOPSIS Methods

From the results of the execution time test of the SAW and TOPSIS methods which were carried out 5 times and presented in Table 14, it can be seen that the SAW method is much faster with an average time required of only 0.10672 seconds, while the TOPSIS method requires an average time of 0.57004 seconds to execute the calculation.

Table 14 . Execution Time Testing

No	Testing to -	Method	
		SAW	TOPSIS
1.	1	0.0495 seconds	0.3784 seconds
2.	2	0.0841 seconds	0.3574 seconds
3.	3	0.1776 seconds	1.3056 seconds
4.	4	0.1355 seconds	0.2968 seconds
5.	5	0.0869 seconds	0.5120 seconds
	Average	0.10672 seconds	0.57004 seconds

CONCLUSION

Based on results study can concluded that : (1) Decision Support System for choosing the best teacher at SMK Swasta PABAKU Stabat has succeed made use method Simple Additive Weighting (SAW) and Technique for

Order of Preference by Similarity to Ideal Solution (TOPSIS) based web . System This Ready used by schools as tool help determine best teacher candidates . The teacher ranking feature using both methods allows schools to choose which method is suitable. The author recommends the SAW method because Based on the level of accuracy, SAW is 53% and TOPSIS is 32%, so SAW is more appropriate to use. (2) The SAW method in terms of execution time is faster, an average of 0.10672 seconds for 19 teachers, while TOPSIS is 0.57004 seconds. Overall, SAW is easier to implement because the calculation is simpler, namely the ranking and score of linear criteria. While TOPSIS is complex with weighting and distance calculations. SAW is also more flexible in combining criteria, while TOPSIS is less because it requires consistency in the weight of the criteria. (3) A decision support system for selecting the best teachers at SMK Swasta PABAKU Stabat has been successfully designed by applying the SAW (Simple Additive Weighting) and TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) methods. The SAW method is more recommended for use because it is considered more accurate, faster, and more flexible in the calculation and decision-making process.

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