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## **Decision Support System for Determining the Best Homeroom Teacher at SMA Negeri 1 Perbaungan Using the Simple Additive Weighting Method**

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### **ABSTRACT**

*Decision Support System (DSS) is a procedure-based model to process data and assist management in making decisions. Computer-based Decision Support System to improve decision-making ability to solve quasi-structured or unstructured problems. One of the methods that can be used to solve problems in this DSS is the Simple Additive Weighting (SAW) method. The SAW method is a method that uses weighted addition. With this method the optimal solution is sought from a number of alternatives and certain criteria. This application is desktop-based so that it can be used by users and aims to make it easier for users to need information and solutions to help choose the best homeroom teacher.*

**Keywords:** *Decision Support System, Simple Additive Weighting, Criteria, Homeroom*

### **1. Introduction**

At this time the use of science and technology is developing very quickly and producing new innovations that must be balanced with the ability to adapt to these technologies. One of these areas is decision support systems that can assist in decision making. A decision support system is a set of integrated computer tools that allow a decision maker to interact directly with a computer, to create useful information in making unanticipated semi-structured decisions (Rotua Sihombing Hutasuhut, Agus Perdana Windarto, Dedy Hartama, Solikum (2016: 56). In this case, computerization is really needed in educational institutions, especially in SMA Negeri 1 Perbaungan for the selection of the best homeroom teacher to be more effective and efficient.

In the process of selecting the best homeroom teacher, SMA Negeri 1 Perbaungan only uses grades in its selection. While there are many aspects that must be considered in the selection of homeroom teachers. The selection and determination of the homeroom teacher is a process that takes a long time and is complicated because SMA Negeri 1 Perbaungan still does it manually. One way to determine the best homeroom teacher is the Simple Additive Weighting (SAW) method. Some of the criteria for selecting the best homeroom teacher include: Pedagogy, personality, social, professional, educational.

In a previous study (Gortap Lumbantoruan, Emma Rosinta Br Simarmata 2018) it was found that the SPK for selecting the best homeroom teacher was based on teacher achievement with an accuracy rate of 70%. According to Rifqi Abdillah and Sofiana

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Agustin (2015) a decision support system is a computer program that combines data and mathematical models to assist the decision-making process directly.

Simple Additive Weighting (SAW) is a method that has the basic concept of finding the weighted sum of the performance branches on each alternative of all attributes. The SAW method requires a process of normalizing the decision matrix to a scale that can be compared with existing alternative branches (Gortap Lumbantorun, Emma Rosinta Br. Simarmata (2018: 231). The SAW method was chosen because it is able to select the best alternative from a number of alternatives based on specified criteria.

By using a decision support system, the SAW method is estimated to be able to overcome the problems that arise in SMA Negeri 1 Perbaungan, namely by determining the decision criteria for selecting the best homeroom teacher, collecting homeroom data based on predetermined criteria so that it can be calculated using the SAW method. and an application was built to facilitate the determination of the best homeroom decision for each homeroom teacher.

## 2. Methodology

The Simple Additive Weighting method can be interpreted as a simple weighting method or a weighted addition to solving problems in a decision support system. The concept of this method is to find a performance rating (priority scale) on each alternative in all attributes.

The steps used in the homeroom determination research using the Simple Additive Weighting method are as follows:

Step 1 : Define in advance the criteria that will be used as a benchmark for solving the problem

Step 2 : Normalize each alternative value on each attribute by calculating the performance rating value

$$r_{ij} = \begin{cases} \frac{X_{ij}}{\text{Max } X_{ij}} & \text{Jika } j \text{ adalah atribut benefit} \\ \frac{\text{Min } X_{ij}}{X_{ij}} & \text{Jika } j \text{ adalah atribut (cost)} \end{cases}$$

Information :

$r_{ij}$  = normalized performance rating value

$x_{ij}$  = attribute value owned by each criterion

Max  $x_{ij}$  = the largest value of each criterion

Min  $x_{ij}$  = the smallest value of each criterion

benefits = if the largest value is the best

cost = if the smallest value is the best

Step 3 : Calculating the value of preference weight on each alternative

Step 4 : Perform ranking.

## 3. Results and Discussion

In the Simple Additive Weighting method there are criteria needed to determine homeroom teachers. The criteria are as follows:

- a. Pedagogy : Mastering the characteristics of students, Mastering learning theory and educational learning principles, Curriculum development, Educational learning activities, Development of student potential
- b. Personality :Act in accordance with national religious, legal, social and cultural, norms.Show a mature and exemplary personality, Work ethic, high responsibility, , pride in being a teacher, ModestyAttractive
- c. Social : Be inclusive, act objectively, and not discriminate, Communication with fellow teachers, education staff, parents, students, and the community, Motivation, Empathy, Philanthrope, Professional, Mastery of materials, structures, concepts and scientific mindsets that support the subjects taught, Developing professionalism through reflective actions, Ability to master Vision and Mission, Understand the concept of child development/developmental psychology, Ability to organize and problem solving
- d. Education :S3, S2, S1, DIII, DII

Table 1.  
 Criteria Table

Criteria	Information
C1	Pedagogic
C2	Personality
C3	Social
C4	Professionalism
C5	Education

### 3.1 Weight

From each of these criteria the weights will be determined. The weight for each criterion has a different amount.The results of the sub-criteria are obtained from assessments in schools by assessing with direct observation and monitoring by the assessor, namely the principal. Ratings are graded on a scale of 1, 2, 3, 4 or 5.The following is a table of weights for each criterion.

- a. Pegadogic Criteria

Table 2.  
 Pedagogic Weight

Criteria	Information	Criteria Set	Weight
C1	Pedagogic	(86-100) Very Good	5
		(76-85) Fine	4
		(66-75) Enough	3
		(51-65) Less	2
		(0-50) Very Poor	1

- b. Personality Criteria



Table 3.

Personality Criteria Weighting Table

Criteria	Information	Criteria Set	Weight
C2	Personality	(86-100) Very Good	5
		(76-85) Fine	4
		(66-75) Enough	3
		(51-65) Less	2
		(0-50) Very Poor	1

c. Social Criteria

Table 4.

Social Criteria Weighting Table

Criteria	Information	Criteria Set	Weight
C3	Social	(86-100) Very Good	5
		(76-85) Fine	4
		(66-75) Enough	3
		(51-65) Less	2
		(0-50) Very Poor	1

d. Professionalism Criteria

Table 5.

Table of Professionalism Criteria Weight

Criteria	Information	Criteria Set	Weight
C4	Professionalism	(86-100) Very Good	5
		(76-85) Fine	4
		(66-75) Enough	3
		(51-65) Less	2
		(0-50) Very Poor	1

e. Education Criteria

Table 6.

Table of Professionalism Criteria Weight

Criteria	Information	Criteria Set	Weight
C4	Professionalism	(86-100) Very Good	5
		(76-85) Fine	4
		(66-75) Enough	3
		(51-65) Less	2
		(0-50) Very Poor	1

### 3.2 Case Examples and Solutions

From the data of a number of teachers in SMA Negeri 1 Perbaungan as shown in table 4.1, four people were taken as examples for the application of the Simple Additive Weighting method in determining homeroom teachers. The value of each teacher can be seen as shown in the following table.

Table 7.  
 Teacher Value Data for Each Criterion

NIP	NAME	Score				
		C1	C2	C3	C4	C5
19650714 200502 2 001	Ir. Julia	80	45	65	75	80
	Tuti Sumiyati	90	70	70	90	75
19770205 200604 2 014	Sipahutar, S.Pd	65	40	80	80	80
19770614 201001 2 014	Asniwati, S.Pd	80	60	70	85	75
19890111 201505 2 001	Dedy Wida I. Simanjuntak, S.Pd					

Based on the steps to determine the homeroom teacher using the Simple Additive Weighting method, what must be done is:

1. Give the value of each alternative (Ai) on each criterion (Cj).
  - a. Pedagogic Value

Table 8.  
 Pedagogic Value

Teacher	Value (C2)	Number SAW	Score
Ir. Julia	C1= 80	Well	4
Tuti Sumiyati Sipahutar, S.Pd	C1= 90	Very good	5
Asniwati, S.Pd	C1= 65	Not enough	2
Dedy Wida I. Simanjuntak, S.Pd	C1= 80	Well	4

- b. Personality Value

Table 9.  
 Personality Value

Teacher	Value (C2)	Number SAW	Score
Ir. Julia	C2= 45	Very less	1
Tuti Sumiyati Sipahutar, S.Pd	C2= 70	Enough	3
Asniwati, S.Pd	C2= 40	Very less	1
Dedy Wida I. Simanjuntak, S.Pd	C2= 60	Not enough	2

- c. Social Value

Table 10.  
 Social Value

Teacher	Value (C3)	Number SAW	Score
Ir. Julia	C3= 65	Not enough	2
Tuti Sumiyati Sipahutar, S.Pd	C3= 70	Enough	3
Asniwati, S.Pd	C3= 80	Well	4
Dedy Wida I. Simanjuntak, S.Pd	C3= 70	Enough	3

- d. Value of Professionalism



Table 11.  
 Value of Professionalism

Teacher	Value (C4)	NumberSAW	Score
Ir. Julia	C4= 75	Enough	3
Tuti Sumiyati Sipahutar, S.Pd	C4= 90	Very good	5
Asniwati, S.Pd	C4= 78	Well	4
Dedy Wida I. Simanjuntak, S.Pd	C4= 85	Well	4

e. Educational Value

Table 12.  
 Educational Value

Teacher	Value (C4)	NumberSAW	Score
Ir. Julia	C5= 80	Well	4
Tuti Sumiyati Sipahutar, S.Pd	C5= 75	Enough	3
Asniwati, S.Pd	C5= 80	Well	4
Dedy Wida I. Simanjuntak, S.Pd	C5= 75	Enough	3

2. Alternative Match Rating

The suitability rating of each alternative on each criterion can be seen in the following table.

Table 13.  
 Match Rating

NAME	Score				
	C1	C2	C3	C4	C5
Ir. Julia	80	45	65	75	80
Tuti Sumiyati Sipahutar, S.Pd	90	70	70	90	75
Asniwati, S.Pd	65	40	80	80	80
Dedy Wida I. Simanjuntak, S.Pd	80	60	70	85	75

3. Decision Matrix Based on Criteria

From the table, the alternative suitability rating is converted into a decision matrix X as follows:

$$X = \begin{matrix} & 4 & 1 & 2 & 3 & 4 \\ & 5 & 3 & 3 & 5 & 3 \\ & 2 & 1 & 4 & 4 & 4 \\ & 4 & 2 & 3 & 4 & 3 \end{matrix}$$

4. Normalize matrix X to matrix R based on equation

Normalization for the criteria used the benefit formula because the largest value is the best value, the following is the result of normalizing the X matrix to the R matrix.

a. For Pedagogic Criteria (C1).

$$r_{1,1} = \frac{4}{\text{Max}\{4,5,2,4\}} = \frac{4}{5} = 0.8$$

$$r_{2,1} = \frac{5}{\text{Max}\{4,5,2,4\}} = \frac{5}{5} = 1$$

$$r_{3,1} = \frac{2}{\text{Max}\{4,5,2,4\}} = \frac{2}{5} = 0.4$$

$$r_{4,1} = \frac{4}{\text{Max}\{4,5,2,4\}} = \frac{4}{5} = 0.8$$

b. For Personality Criteria (C2).

$$r_{1,2} = \frac{1}{\text{Max}\{1,3,1,2\}} = \frac{1}{3} = 0.3333333333333333$$

$$r_{2,2} = \frac{3}{\text{Max}\{1,3,1,2\}} = \frac{3}{3} = 1$$

$$r_{3,2} = \frac{1}{\text{Max}\{1,3,1,2\}} = \frac{1}{3} = 0.3333333333333333$$

$$r_{4,2} = \frac{2}{\text{Max}\{1,3,1,2\}} = \frac{2}{3} = 0.6$$

c. For Social Criteria (C3).

$$r_{1,3} = \frac{2}{\text{Max}\{2,3,4,3\}} = \frac{2}{4} = 0.5$$

$$r_{2,3} = \frac{3}{\text{Max}\{2,3,4,3\}} = \frac{3}{4} = 0.75$$

$$r_{3,3} = \frac{4}{\text{Max}\{2,3,4,3\}} = \frac{4}{4} = 1$$

$$r_{4,3} = \frac{3}{\text{Max}\{2,3,4,3\}} = \frac{3}{4} = 0.75$$

d. For Professionalism Criteria (C4).

$$r_{1,4} = \frac{3}{\text{Max}\{3,5,4,4\}} = \frac{3}{5} = 0.6$$

$$r_{2,4} = \frac{5}{\text{Max}\{3,5,4,4\}} = \frac{5}{5} = 1$$

$$r_{3,4} = \frac{4}{\text{Max}\{3,5,4,4\}} = \frac{4}{5} = 0.8$$

$$r_{4,4} = \frac{4}{\text{Max}\{3,5,4,4\}} = \frac{4}{5} = 0.8$$

e. For Education Criteria (C5).

$$r_{1,5} = \frac{4}{\text{Max}\{4,3,4,3\}} = \frac{4}{4} = 1$$

$$r_{2,5} = \frac{3}{\text{Max}\{4,3,4,3\}} = \frac{3}{4} = 0.75$$

$$r_{3,5} = \frac{4}{\text{Max}\{4,3,4,3\}} = \frac{4}{4} = 1$$

$$r_{4,5} = \frac{3}{\text{Max}\{4,3,4,3\}} = \frac{3}{4} = 0.75$$



Then from the above calculation, the normalized matrix value is obtained. This value will be made into the normalization matrix. The following is a normalization matrix that has been calculated using the benefit formula:

$$X = \begin{matrix} & 0.8 & 0.33333333333333 & 0.5 & 0.6 & 1 \\ & 1 & & 0.75 & 1 & 0.75 \\ & 0.4 & 0.33333333333333 & 1 & 0.8 & 1 \\ & 0.8 & 0.66666666666666 & 0.75 & 0.8 & 0.75 \end{matrix}$$

#### 5. Ranking

Furthermore, the  $W * R$  matrix multiplication will be made and the addition of the multiplication results will be made to obtain the best alternative by ranking the largest values as follows:

The value of  $W$  is a predetermined value, namely the weight vector:

$$W = (5; 5; 5; 5; 5)$$

The calculation is as follows

$$\begin{aligned} A1 &= (5 \times 0.8) + (5 \times 0.33333333333333) + (5 \times 0.5) + (5 \times 0.6) + (5 \times 1) \\ &= 4 + 1.66666666666667 + 2.5 + 3 + 5 \\ &= 16.16666666666667 \end{aligned}$$

$$\begin{aligned} A2 &= (5 \times 1) + (5 \times 1) + (5 \times 0.75) + (5 \times 1) + (5 \times 0.75) \\ &= 5 + 5 + 3.75 + 5 + 3.75 \\ &= 22.5 \end{aligned}$$

$$\begin{aligned} A3 &= (5 \times 0.4) + (5 \times 0.33333333333333) + (5 \times 1) + (5 \times 0.8) + (5 \times 1) \\ &= 2 + 1.66666666666667 + 5 + 4 + 5 \\ &= 17.66666666666667 \end{aligned}$$

$$\begin{aligned} A4 &= (5 \times 0.8) + (5 \times 0.66666666666666) + (5 \times 0.75) + (5 \times 0.8) + (5 \times 0.75) \\ &= 4 + 3.33333333333333 + 3.75 + 4 + 3.75 \\ &= 18.33333333333333 \end{aligned}$$

After getting the multiplication results with the  $W * R$  matrix and the addition of the multiplication results, the final decision values will be obtained as follows:

Table 14.  
 Ranking Results

No	Alternative	Ranking Results
1	Tuti Sumiyati Sipahutar, S.Pd	22.50
2	Dedy Wida I. Simanjuntak, S.Pd	18.83333333333333
3	Asniwati, S.ssPd	17.66666666666667
4	Ir. Julia	16.16666666666667

#### 4. Conclusion

Based on the research and description above, Problems that occur regarding the determination of whether or not the homeroom teacher is eligible can be resolved by applying the Simple Additive Weighting (SAW) Method. By applying the Simple Additive Weighting (SAW) method for selecting the best homeroom teacher, it can be adjusted to the criteria and use weights so that it can be used with the algorithm.

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