
Decision Support System for Determining Homeroom Teachers at SMPN 3 Porsea Using the Simple Additive Weighting Method

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ABSTRACT

Determination of homeroom teachers at SMPN 3 Porsea using the Simple Additive Weighting method. The model used in this decision support system is Fuzzy Multiple Attribute Decision Making (FMADM) which is a system that can produce an alternative decision that can be used as a tool in making decisions. Based on government demands in the field of education to improve the quality of homeroom teachers, system development This decision support is one way to assist in determining the appropriate teacher to be a homeroom teacher. The SAW method was chosen because this method determines the weight value for each attribute, then proceed with a ranking process that will select the best alternative from a number of alternatives in question, namely the teacher who has the highest score based on each predetermined criterion. With this ranking method, the assessment will be more precise because it is based on the criteria and weights that have been determined so as to get accurate results as a decision aid to determine the homeroom teacher at SMPN 3 Porse.

Keywords: *Decision Support System, Simple Additive Weighting, Fuzzy Multiple Attribute Decision Making*

1. Introduction

The teacher is the most important educator factor in an educational institution, especially in the homeroom teacher because it can be said to be a substitute for parents in the classroom. Therefore, schools are increasingly improving the quality of teacher performance, especially for homeroom teachers. So far, in determining homeroom teachers, principals still use a manual assessment system in assessing teacher performance to determine proper homeroom teachers, with manuals, on subjective sheets, manual calculations of the value of each teacher's performance criteria, so the results are less accurate. From the problems that have been researched, the school decided to make a Web-based Decision Support System application. Made web-based with the aim that in the future it will not only be desktop (standalone),

The model used in this decision support system is Fuzzy Multiple Attribute Decision Making (FMADM) which is a system that can produce an alternative decision that can be used as a tool in making decisions. The SAW method was chosen because this method determines the weight value for each attribute, then followed by a ranking process that will select the best alternative from a number of alternatives in question, namely the teacher who has the highest score based on each predetermined criterion.

The system that will be made by SMP Negeri 3 Porsea is a Decision Support System for Determining Homeroom Teachers using the SAW method, this system has a

login display, teacher data input, criteria data input, classification data input, initial analysis results display, initial matrix display, display normalization results, and ranking results.

2. Methodology

2.1 Decision Support System (DSS).

Decision Support System / *Decision Support System (DSS)* is an interactive information system that provides information, modeling, and manipulating data. This system is used to assist decision making in semi-structured and unstructured situations, where no one knows for sure how decisions should be made. [1].

2.2 SAW (Simple Additive Weighting)

The SAW method is often also known as the weighted addition method. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative on all attributes. The SAW method requires the process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings. [2].

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\max x_{ij}} & \text{Jika } j \text{ adalah atribut keuntungan (benefit)} \\ \frac{\min x_{ij}}{x_{ij}} & \text{Jika } j \text{ adalah atribut biaya (cost)} \end{cases}$$

Information :

r_{ij} = normalized performance rating value

x_{ij} = attribute value owned by each criterion

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

i

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

i

Benefit = if the biggest value is the best

Cost = if the smallest value is the best

Where r_{ij} is the normalized performance rating of alternative A_i on attributes $C_j; j=1,2,\dots,m$ and $j=1,2,\dots,n$. The preference value for each alternative (V_i) is given as:

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

Information :

V_i = rank for each alternative

w_j = weight value of each criterion

r_{ij} = normalized performance rating value [2].

Resolution Step



In this study using the FMADM model with the SAW method. The steps are as follows:[4] (a) Giving the value of each alternative (A_i) on each criterion (C_j) that has been determined, where the value of $i=1,2,\dots,m$ and $j=1,2,\dots,n$. 2. (b) Gives the weight value (w) which is also obtained based on the crisp value. (c) Normalize the matrix by calculating the normalized performance rating value (r_{ij}) from the alternative A_i on the C_j attribute based on an equation that is adjusted to the type of attribute (benefit attribute = MAXIMUM or cost attribute = MINIMUM). If it is a profit attribute, the crisp value (X_{ij}) of each attribute column is divided by the crisp MAX value (MAX X_{ij}) of each column, while for the cost attribute, the crisp MIN (MIN X_{ij}) value of each attribute column is divided by the crisp value (X_{ij}). each column (d) Perform the ranking process for each alternative (V_i) by multiplying the weight value (w_i) with the normalized performance rating value (r_{ij}). [2].

2.3 Criteria

The criteria for determining the prospective homeroom teacher are as follows: C1 = Professionalism, C2 = Pedagogic, C3 = Personality , C4 = Social Sense.

2.4 Weight

From each of these criteria the weights will be determined. The weight for each criterion has a different amount. The following is a table of weights for each criterion.

Table 1.
 Professionalism Weighting (C1)

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

Table 2.
 Pedagogic Weighting (C2)

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

Table 3.
 Personality Weighting (C3)

Criteria	Criteria Set	Weight
C3	(86-100) Very Good	5
C3	(76-8) Fine	4

C3	(66-75) Enough	3
C3	(51-65) Less	2
C3	(0-50) Very Poor	1

Table 4.
Social Sense Weighting (C4)

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

Table 5.
SAW Eligibility Value

No	Score	Category
1	16 – 20	Worthy
2	1 – 15	Not feasible

3. Results and Discussion

From a number of teachers at SMP N 3 Porsea, three 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 5.
Teacher's Grade

Name	Score			
	(C1)	(C2)	(C3)	(C4)
Drs. T. Sirait	75	80	45	65
Dra. L. Situmorang	br. 90	90	70	90
Dra. R. Simanjuntak	br. 80	65	40	80

Based on the steps to determine the homeroom teacher using the Simple Additive Weighting method, what must be done is to provide a value for each alternative (Ai) on each criterion (Cj) that has been determined.

Table 6.
Value of Professionalism

Teacher	Value (C5)	SAW number	Score
Drs. T. Sirait	C1= 75	Enough	3
Dra. L.	br.C1= 90	Very good	5
Dra. R.	br.C1= 80	Well	4



Table 7.
 Pedagogic Value

Teacher	Value	SAW number	Score
Drs. T. Sirait	C2= 80	Well	4
Dra. L. br. Situmorang	C2= 90	Very good	5
Dra. R. br. Simanjuntak	C2= 65	Well	2

Table 8.
 Personality Value

Teacher	Value	SAW number	Score
Drs. T. Sirait	C3= 45	Very less	1
Dra. L. br. Situmorang	C3= 70	Enough	3
Dra. R. br.	br.C3= 40	Very less	1

Table 9.
 Social Sense Value

Teacher	Value	SAW number	Score
Drs. T. Sirait	C4= 65	Not enough	2
Dra. L. br. Situmorang	C4= 70	Enough	3
Dra. R. br.	br.C4= 80	Well	4

3.1 Alternative Match Rating

The table below shows the suitability rating of each alternative on each criterion.

Table 10.
 The compatibility rating of each alternative

Alternative	Criteria			
	Criteria			
	C1	C2	C3	C4
Drs. T. Sirait	3	4	1	2
Dra. L. br. Situmorang	5	5	3	3
Dra. R. br. Simanjuntak	br.4	2	1	4

3.2 Decision matrix based on criteria

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

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

Normalize matrix X to matrix R based on the equation.

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

Information :

- rij = normalized performance rating value
- xij = attribute value owned by each criterion
- Max xij = the largest value of each criterion
- Min xij = the smallest value of each criterion
- benefits = if the largest value is the best
- cost = if the smallest value is the best

Normalization for the criteria can be seen as follows.

a. For Professionalism Criteria (C1)

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

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

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

b. For Pedagogic Criteria (C2)

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

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

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

c. For Personality Criteria (C3)

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

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

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

d. For Social Sense Criteria (C4)

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

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

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



Then from the above calculation, the normalized matrix value is obtained. This value will be made into the normalization matrix. The following is the result of the normalization matrix calculation, as follows:

$$\left\{ \begin{array}{ccc} 0.6 & 0.8 & 0.3333333333: 0.5 \\ 1 & 1 & 1 & 0.75 \\ 0.8 & 0.4 & 0.3333333333: 1 \end{array} \right\}$$

3.3 Ranking

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

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

Information :

- V_i = rank for each alternative
- w_j = weight value of each criterion
- r_{ij} = normalized performance rating value

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

$$W = [3; 5; 5; 5; 5], \text{ and}$$

The calculation is as follows,

$$\begin{aligned} A1 &= (5 \times 0.8) + (5 \times 0.3333333333333333) + (5 \times 0.5) + (5 \times 0.6) \\ &= 4 + 1.666666666666667 + 2.5 + 3 \\ &= 11.166666666666667 \\ A2 &= (5 \times 1) + (5 \times 1) + (5 \times 0.75) + (5 \times 1) \\ &= 5 + 5 + 3.75 + 5 \\ &= 18.75 \\ A3 &= (5 \times 0.4) + (5 \times 0.3333333333333333) + (5 \times 1) + (5 \times 0.8) \\ &= 2 + 1.666666666666667 + 5 + 4 \\ &= 12.666666666666667 \end{aligned}$$

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:

No	Alternative	Ranking Results	Eligibility Category
1	Drs. T. Sirait	11.17	Not feasible
2	Dra. L.	br.18.75	Worthy
3	Dra. R.	br.12.67	Not feasible

Then after doing the ranking process, then between V_1 , V_2 , and V_2 the largest value is V_2 , because it refers to the table of limits on the feasibility value that the value in the final value of the calculation of the proper SAW method must reach 16 so that the selected candidate is V_2 Dra. L. br. Situmorang whose final calculation value exceeds 16 is 18.75. To test the accuracy of the Simple Additive Weighting (SAW) method in

determining the alternative teacher selected to be homeroom teacher from several alternatives in determining the most influential supporting factors in the teacher performance assessment process, a decision support system application is needed.

4 Conclusion

Based on research conducted by researchers, it can be concluded several things as follows: The existence of a decision support system to determine homeroom teachers at SMP Negeri 3 Porsea will assist the principal in determining homeroom teachers for each class. With this decision support system, it proves that the Simple Additive Weighting method has been successfully implemented into the system and has been proven during research testing. The calculation of the different weight values of each criterion will produce different values and produce different decisions

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