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DECISION SUPPORT SYSTEM FOR DETERMINING THE BEST TEACHER USING TOPSIS METHOD (CASE STUDY : SMP NEGERI 1 GALANG)

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Abstract

SMP Negeri 1 Galang has an activity in determining the best teacher, however, at SMP Negeri 1 Galang the determination of the best teacher still uses the manual method, namely by calculating on paper with a predetermined format. In this case, of course, it takes a long time, considering that there are many junior high school teachers, and also requires many criteria. This is what makes researchers want to conduct research in order to design a decision support system for determining the best teacher using the TOPSIS method at the 1st Galang Junior High School. The Technique for Order Preference by Similarity to Ideal Solution (Topsis) method is one method that is often used in determining a decision, therefore researchers use this method in making a system. With the existence of a decision support system, it can help the school in determining the best teacher, so that the determination of the best teacher can be done accurately and quickly

***Keywords**: Decision Support System, Determination of the Best Teacher, Topsis*

1. Introduction

The development of computer technology has had an important impact in all fields. This results in all work activities involving computers. With the involvement of computer technology can help humans in solving a problem in any field such as in the fields of education, health and others. As in the field of education, computer technology can play an important role if this technology is developed and can solve problems such as speeding up the work of determining the best teacher in a school. One of the developments in computer technology that can be used in the field of education is the application of decision support systems. The teacher is an important element in education, besides that the teacher is also a determinant of the high and low quality of education. Therefore, it is necessary to determine the best teacher to improve the quality of a teacher. The quality of a teacher is very important in determining the quality of educational outcomes because the teacher is a person who often interacts directly with students during the learning process. Likewise with teachers in junior high schools, these schools routinely determine the quality of a teacher. However, in determining the quality of teachers for SMP Negeri 1 Galang, they still use an unsatisfactory method so that the results obtained take a long time and are less precise. This problem can be solved by using a decision support system application, which is to support the way the system works to find results using the Technique for Order Preference by Similarity to Ideal Solution (Topsis) method. The Topsis method is part of the SPK, which takes the best decision based on multi-criteria problem. Topsis ranks alternatives based on the priority value of the relative closeness of an alternative to the positive ideal solution. [1] In previous research [2] using the topsis method in selecting the best teacher in this study there were criteria in the form of absenteeism, curriculum development, motivational ability, responsibility and mastery of the material. In another study [3] with the title of the best teacher selection decision support system at SMK Maria Goretti Pematang Siantar using the simple additive weighting (SAW) method, this study still uses the vb programming language. Then in this study [4] there are 4 teachers as alternative candidates and use 5 criteria as an assessment. Then the research that has been done using the Weighted Product (WP) method in selecting the best teacher at MAN 1 Pariaman, in the assessment process there are several stages, namely determining the importance level scale, criteria, weight of assessment and after that a ranking of the best teachers is made with this method. Another study [5] conducted with the title of the best teacher selection decision support system using the Additive Ratio Assessment (ARAS) method with criteria data in the form of absenteeism, achievement, latest education, failure rate and personality. In this study, the conclusion is the application of the ARAS method by calculating alternative values based on the ARAS algorithm in order to get the highest ranking alternative. And other research [6] conducted with the Topsis method with the selection of outstanding teachers at SMK Negeri 1 Pantai Labu which concluded that the selection of teachers with the Topsis method could help the school to select outstanding teachers. The purpose of this study was to assist the school in determining the best teacher at SMP Negeri 1 Galang with the application and the assessment process using the Topsis method so as to produce the right ranking and not take a long time.

2. Methodology

In this research method there is a research framework and there are also criteria for the method used in determining the best teacher.

A. Research Framework

The research framework is an overview of the workings and steps of conducting research.

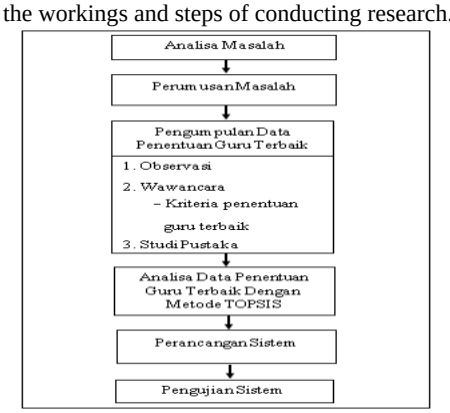

Figure 1. Research Framework

Framework Description

The description of the framework in Figure 1 above is as follows:

1. Problem Analysis
   This framework starts with analyzing the problem. The analysis carried out in this study is about the main problems carried out. Determine what data will be used to build the system and determine the criteria for the problems that exist in the research.
2. Problem Formulation
   The next step is the formulation of the problem, the formulation of the problem in question is about how to build a decision support system to determine the best teacher by applying the Technique for Order Preference by Similarity to deal Solution (Topsis) method.
3. Data Collection Determination of the Best Teacher
   The next step is to collect data to determine the best teacher. This data collection was carried out in 3 ways, including observation, interviews and literature study. This data collection is useful as a support in research.
   Observation
   Observation is one way of collecting data by observing directly in order to obtain accurate information and data that can be used to build a system for determining the best teacher using the Technique for Order Preference by Similarity to Ideal Solution (Topsis) method.
   Interview (interview)
   Conduct interviews (interviews) to related parties by communicating directly to find out the criteria in determining the best teacher. Criteria for Determining the Best Teacher. The criteria in determining the best teacher is the basis of a measure used in assessing the quality of a good teacher. This criterion will be the measuring tool in this study.
   Literature review
   At this stage, data collection will be carried out from books, journals and articles on the internet related to the problems discussed, namely the decision support system for determining the best teacher with the Technique for Order Preference by Similarity to Ideal Solution (Topsis) method.
4. Data Analysis of Determining the Best Teacher Using the TOPSIS Method
   After collecting data to determine the best teacher, the next step is to analyze the criteria for determining the best teacher. After analyzing, the next step is to determine the weight of the criteria for the best teacher, namely the use of the Technique for Order Preference by Similarity to Ideal Solution (Topsis) method, such as Service Orientation, Integrity and so on which makes the data useful in determining the best teacher.
5. System Design
   At this stage the researcher designed a system using the Technique for Order Preference by Similarity to Ideal Solution (Topsis) method and a system designed with PHP (Hypertext Preprocessor).
6. System Test
   At this stage the researcher will test the system that has been completed, find out if there are errors or errors that still exist in the system, to be further repaired so that it can assist in determining the best teacher.

3. Results And Discussion

The school of SMP Negeri 1 Galang often has difficulty in determining the best teacher because in determining the best teacher they still use the manual method and the results obtained sometimes experience errors and take a long time. Based on that problem, a system was formed to solve the problems experienced by SMP Negeri 1 Galang so as not to experience incidents in determining the best teacher.

Table 1. Teacher Data for SMP Negeri 1 Galang

No	Name	service orientation	integrity	commitment	discipline	cooperation
1	Ratna Erida Purba, S.Pd	90	80	90	95	90
2	Bentiana Meliawati, S.Pd	78	90	95	50	89
3	Priyoto, S.Pd	90	80	90	95	95
4	Nuraini, S.Pd	50	80	90	95	80
5	Fajar Lisensi Girsang, S.Pd	88	86	80	90	91
6	Risma Hutasoit, S.Pd	86	83	89	90	90
7	Murdani Saragih, S.Pd	94	80	91	90	80
8	Julianus, S.Pd	85	82	88	89	90
9	Poppi Nurna Ningsih, S.Pd	82	87	87	88	88
10	Marsita, S.Pd	75	84	82	83	93
11	Zulkifli, S.Pd	90	86	78	81	78
12	Seksiowani, S.Ag	96	88	50	85	50

There are 5 teachers whose performance will be assessed based on predetermined criteria. The 5 people who will be the alternatives include:

A1 = Marsita, S.Pd

A2 = Bentiana Meliawati, S.Pd

A3 = Nuraini,S.Pd

A4 = Murdani Saragih, S.Pd

A5 = Julian, S.Pd

There are five criteria and weights used in determining the best teacher, namely:

C1 = Service Orientation : 10%

C2 = Integrity : 10%

C3 = Commitment : 20%

C4 = Discipline : 30%

C5 = Cooperation : 30%

There are several steps to perform calculations in determining the best teacher using the Topsis method according to the example above, namely:

1. The first step is to determine the value of each alternative with the criteria, namely the value of the predetermined criteria :

Table 2. Value of Each Alternative

Kode	Nama	C1	C2	C3	C4	C5
A1	Marsita,S.Pd	2	3	3	3	3
A2	Bentiana Meliawati,S.Pd	2	3	3	1	3
A3	Nuraini,S.Pd	1	2	3	3	2
A4	Murdani Saragih,S.Pd	3	2	3	3	2
A5	Julianus,S.Pd	3	3	3	3	3

2. The next step is to build a decision matrix with the following formula :

$$\mathbf{Rij} = \frac{Xij}{\sqrt{\sum_{i=1}^{m} X^2 ij}}$$

$$X1 = \sqrt{2^2 + 2^2 + 1^2 + 3^2 + 3^2}$$
$$= \sqrt{4 + 4 + 1 + 9 + 9}$$
$$= \sqrt{27}$$
$$= 5.1961$$

$$r(11) = \frac{x11}{x1} = \frac{2}{5.1961} = 0.3849$$
$$r(21) = \frac{x21}{x1} = \frac{2}{5.1961} = 0.3849$$
$$r(31) = \frac{x31}{x1} = \frac{1}{5.1961} = 0.1925$$
$$r(41) = \frac{x41}{x1} = \frac{3}{5.1961} = 0.5774$$
$$r(51) = \frac{x51}{x1} = \frac{3}{5.1961} = 0.5774$$

$$X2 = \sqrt{3^2 + 3^2 + 2^2 + 2^2 + 3^2}$$
$$= \sqrt{9 + 9 + 4 + 4 + 9}$$
$$= \sqrt{35}$$
$$= 5.9160$$

$$r(12) = \frac{x12}{x2} = \frac{3}{5.9160} = 0.5071$$
$$r(22) = \frac{x22}{x2} = \frac{3}{5.9160} = 0.5071$$
$$r(32) = \frac{x32}{x2} = \frac{2}{5.9160} = 0.3381$$
$$r(42) = \frac{x42}{x2} = \frac{2}{5.9160} = 0.3381$$
$$r(52) = \frac{x52}{x2} = \frac{3}{5.9160} = 0.5071$$

X3 $= \sqrt{3^2 + 3^2 + 3^2 + 3^2 + 3^2}$
$= \sqrt{9 + 9 + 9 + 9 + 9}$
$= \sqrt{45}$
$= 6.7082$

r(13) $= \frac{x13}{x3} = \frac{3}{6.7082} = 0.4472$
r(23) $= \frac{x23}{x3} = \frac{3}{6.7082} = 0.4472$
r(33) $= \frac{x33}{x3} = \frac{3}{6.7082} = 0.4472$
r(43) $= \frac{x43}{x3} = \frac{3}{6.7082} = 0.4472$
r(53) $= \frac{x53}{x3} = \frac{3}{6.7082} = 0.4472$

X4 $= \sqrt{3^2 + 1^2 + 3^2 + 3^2 + 3^2}$
$= \sqrt{9 + 1 + 9 + 9 + 9}$
$= \sqrt{37}$
$= 6.0827$

r(14) $= \frac{x14}{x4} = \frac{3}{6.0827} = 0.4932$
r(24) $= \frac{x24}{x4} = \frac{1}{6.0827} = 0.1644$
r(34) $= \frac{x34}{x4} = \frac{3}{6.0827} = 0.4932$
r(44) $= \frac{x44}{x4} = \frac{3}{6.0827} = 0.4932$
r(54) $= \frac{x44}{x4} = \frac{3}{6.0827} = 0.4932$

X5 $= \sqrt{3^2 + 3^2 + 2^2 + 2^2 + 3^2}$
$= \sqrt{9 + 9 + 4 + 4 + 9}$
$= \sqrt{37}$
$= 5.9160$

r(15) $= \frac{x15}{x5} = \frac{3}{5.9160} = 0.5071$
r(25) $= \frac{x25}{x5} = \frac{3}{5.9160} = 0.5071$
r(35) $= \frac{x35}{x5} = \frac{2}{5.9160} = 0.3381$
r(45) $= \frac{x45}{x5} = \frac{2}{5.9160} = 0.3381$
r(55) $= \frac{x55}{x5} = \frac{3}{5.9160} = 0.5071$

3. The next step is to determine a weighted normalized decision matrix with a predetermined weight value. The following is the formula for the weighted normalized decision matrix :

yij $= w_i \, r_{ij}$

Table 3. Result of Decision Matrix

y1	y2	y3	y4	y5
0.03849	0.05071	0.08944	0.14796	0.15213
0.03849	0.05071	0.08944	0.04932	0.15213
0.01925	0.03381	0.08944	0.14796	0.10142
0.05774	0.03381	0.08944	0.14796	0.10142
0.05774	0.05071	0.08944	0.14796	0.15213

Information :
The value of C1 is multiplied by the weight of 10%
The value of C2 is multiplied by the weight of 10%
The value of C3 is multiplied by the weight of 20%
The value of C4 is multiplied by the weight of 30%
The value of C5 is multiplied by the weight of 30%

4. The next step is to determine the positive ideal solution and the negative ideal solution with the following formula :

$A^+ = (y_1^+ y_2^+ \ldots . y_n^+)$
$A^- = (y_1^- y_2^- \ldots . y_n^-)$

Table 4. Positive Ideal Solution and Negative Ideal Solution

	y1	y2	y3	y4	y5
Ideal Solution	0.03849	0.05071	0.08944	0.14796	0.15213
	0.03849	0.05071	0.08944	0.04932	0.15213
	0.01925	0.03381	0.08944	0.14796	0.10142
	0.05774	0.03381	0.08944	0.14796	0.10142
	0.05774	0.05071	0.08944	0.14796	0.15213
A (+)	**0.05744**	**0.05071**	**0.08944**	**0.14796**	**0.15213**
A (-)	**0.01925**	**0.03381**	**0.08944**	**0.04932**	**0.10142**

5. Then calculate the separation (distance) of the positive ideal solution and the negative ideal solution with the following formula :

$$D_i^+ = \sqrt{\sum_{i-1}^{n}(y_i^+ - y_{ij})2}$$

D1+ $= \sqrt{(0.03849-0.05744)^2+(0.05071-0.05071)^2+(0.08944-0.08944)^2+(0.14796-0.14796)^2+(0.15213-0.15213)^2}$

$= \sqrt{0.01925^2+0^2+0^2+0^2+0^2}$

$= \sqrt{0.0003705625}$

$= 0.01925$

D2+ $= \sqrt{(0.03849-0.05744)^2+(0.05071-0.05071)^2+(0.08944-0.08944)^2+(0.04932-0.14796)^2+(0.15213-0.15213)^2}$

$= \sqrt{0.01925^2+0^2+0^2+0^2+0.09864^2+0^2}$

$= \sqrt{0.0003705625+0+0+0.0097298496+0}$

$= \sqrt{0.0101004121}$

$= 0.100500806 \Rightarrow 0.1005$

D3+ $= \sqrt{(0.01925-0.05744)^2+(0.03381-0.05071)^2+(0.08944-0.08944)^2+(0.14796-0.14796)^2+(0.10142-0.15213)^2}$

$= \sqrt{0.03849^2+0.0169^2+0^2+0^2+0.05071^2}$

$= \sqrt{0.0014814801+0.00028561+0+0+0.0025715041}$

$= \sqrt{0.0043385942}$

$= 0.0658680059 \Rightarrow 0.06587$

D4+ $= \sqrt{(0.05774-0.05744)^2+(0.03381-0.05071)^2+(0.08944-0.08944)^2+(0.14796-0.14796)^2+(0.10142-0.15213)^2}$

$= \sqrt{0^2+0.0169^2+0^2+0^2+0.05071^2}$

$= \sqrt{0+0.00028561+0+0+0.0025715041}$

$= \sqrt{0.0028571141}$

$= 0.0534519794 \Rightarrow 0.05345$

D5+ $= \sqrt{(0.05744-0.05744)^2+(0.05071-0.05071)^2+(0.08944-0.08944)^2+(0.14796-0.14796)^2+(0.15213-0.15213)^2}$

$= \sqrt{0^2+0^2+0^2+0^2+0^2}$

$= \sqrt{0+0+0+0+0}$

$= \sqrt{0}$

$= 0$

Calculate the alternative separation or distance from the negative (D-) ideal solution :

$$D_i^- = \sqrt{\sum_{i-1}^{n}(y_{ij}-y_i^-)2}$$

D1- $= \sqrt{(0.03849-0.01925)^2+(0.05071-0.03381)^2+(0.08944-0.08944)^2+(0.14976-0.04932)^2+(0.15213-0.10142)^2}$

$= \sqrt{0.01924^2+0.0169^2+0^2+0.09864^2+0.05071^2}$

$= \sqrt{0.0003701776+0.00028561+0+0.0097298496+0.0025715041}$

$= \sqrt{0.0129571413}$

$= 0.11382944 \Rightarrow 0.11383$

D2- $= \sqrt{(0.03849-0.01925)^2+(0.05071-0.03381)^2+(0.08944-0.08944)^2+(0.04932-0.04932)^2+(0.15213-0.10142)^2}$

$= \sqrt{0.01924^2+0.0169^2+0^2+0^2+0.05071^2}$

$= \sqrt{0.0003701776+0.00028561+0+0+0.0025715041}$

$= \sqrt{0.0032272917}$

$= 0.0568092572 \Rightarrow 0.05681$

D3- $= \sqrt{(0.01925-0.01925)^2+(0.03381-0.03381)^2+(0.08944-0.08944)^2+(0.14796-0.04932)^2+(0.10142-0.10142)^2}$

$= \sqrt{0^2+0^2+0^2+0.09864^2+0^2}$

$= \sqrt{0+0+0+0.0097298496+0}$

$= \sqrt{0.0097298496}$

$= 0.09864$

D4- $= \sqrt{(0.05744-0.01925)^2+(0.03381-0.03381)^2+(0.08944-0.08944)^2+(0.14796-0.04932)^2+(0.10142-0.10142)^2}$

$= \sqrt{0.03819^2+0^2+0^2+0.09864^2+0^2}\backslash$

$= \sqrt{0.0014584761+0+0+0.0097298496+0}$

$= \sqrt{0.011883257}$
$= 0.105884882 \Rightarrow 0.10588$

$$D5- = \sqrt{\begin{matrix}(0.05744 - 0.01925)^2 + (0.05071 - 0.03381)^2 + (0.08944 - 0.08944)^2 \\ + (0.14796 - 0.04932)^2 + (0.15213 - 0.10142)^2\end{matrix}}$$

$= \sqrt{0.03819^2 + 0.0169^2 + 0^2 + 0.09864^2 + 0.05071^2}$
$= \sqrt{0.0014584761 + 0.00028561 + 0 + 0.0097298496 + 0.0025715041}$
$= \sqrt{0.0140454398}$
$= 0.118613458 \Rightarrow 0.11861$

6. The next step is to calculate the V-preference value. The formula for the V preference value is :

$$\mathbf{Vi} = \frac{\mathbf{Di^-}}{\mathbf{Di^- + Di^+}}$$

$V1 = \frac{D1^-}{D1^- + D1^+} = \frac{0.11383}{0.11383 + 0.01925} = 0.85538$
$V2 = \frac{D2^-}{D2^- + D2^+} = \frac{0.05681}{0.05681 + 0.1005} = 0.36114$
$V3 = \frac{D3^-}{D3^- + D3^+} = \frac{0.09864}{0.09864 + 0.06587} = 0.5996$
$V4 = \frac{D4^-}{D4^- + D4^+} = \frac{0.10588}{0.10588 + 0.05345} = 0.66453$
$V5 = \frac{D5^-}{D5^- + D5^+} = \frac{0.}{0 + 0.11861} = 1$

From the calculation of the value of V (the proximity of each alternative to the ideal solution) the largest value is obtained by V5=1 so that it will be selected as the best teacher at SMP Negeri 1 Galang.

4. Conclusion

Based on the results of research conducted at SMP Negeri 1 Galang in the application of a decision support system for determining the best teacher using the Topsis method, it can be concluded that:
Based on the evaluation of the system in the trials carried out, an application for determining the teacher was produced that was able to determine the best teacher at SMP Negeri 1 Galang, while at the same time producing a report that was in accordance with the value of the calculation results of the existing criteria, so that in the process of determining the best teacher it was computerized and the Technique for Order method Preference by Similarity to Ideal Solution (Topsis) can be applied to the application of a decision support system to determine the best teacher because it can determine the highest weight and rank. The results of this application can save the principal's performance activities. Where in determining the best teacher already has valid data to be used by the principal and used as consideration for the principal and other teachers.
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References

[1] M. E. Marpaung and A. S. Rms, “Penilaian Guru Terbaik SMP Tri Sakti Lubuk Pakam Menggunakan Metode Topsis,” vol. 5, no. 1, pp. 28–35, 2018.
[2] H. Ardiansyah, T. Informatika, U. Pamulang, S. P. Keputusan, and L. Belakang, “SISTEM PENUNJANG KEPUTUSAN PEMILIHAN GURU TERBAIK DENGAN METODE TOPSIS (TECHNIQUE FOR ORDER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION) STUDI KASUS : SDN BENDUNGAN HILIR 01 PAGI JAKARTA,” vol. 2, no. 2, pp. 89–96, 2017.
[3] S. Utara-indonesia, “2 , 3 , 4,” vol. 1, 2016.
[4] P. M. A. N. Pariaman, “Sistem Pendukung Keputusan Pemilihan Guru Terbaik dengan Metode Weighted Product,” vol. 6, no. 2, pp. 310–321, 2019.
[5] M. Sulehu and L. Handayani, “Sistem Pendukung Keputusan Pemilihan Guru Terbaik Menggunakan Metode Additive Ratio Assessment (ARAS),” pp. 431–441, 2019.
[6] Y. Perwira, “Sistem Pendukung Keputusan Pemilihan Guru Berprestasi di SMK Negeri 1 Pantai Labu Dengan Menggunakan Metode Technique For Order Of Preference By Similarity To Ideal Solution (Topsis),” vol. 3, no. 3, pp. 229–250, 2021.