

Assessment of Teacher Performance Using Technique For Other Preference By Similarity To Ideal Solution (TOPSIS)

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Abstract—Teacher performance assessment is intended to create a professional teacher. Every teacher is a professional in his or her field and in recognition of their work performance, teacher performance assessment should be done to teachers in all formal education units organized by the government. Problems encountered in teacher performance appraisal are still not done computationally therefore a system that can help schools in assessing teacher performance is required. Decision support system is a computerized system capable of processing data into information to take decisions from the problem of semi-structured specific and unstructured. The method used is the *Technique for Other Preference by Similarity to Ideal Solution (TOPSIS)* as one of the multicriteria decision-making methods with the principle that the chosen alternative must have the closest distance from the ideal ideal solution and furthest from the negative ideal. TOPSIS method in this system is used as computation calculation every teacher value and produce output in the form of recommendation of teacher with best performance.

Keywords— Decision Support System; Assessment of Teacher Performance; Technique for Other by Similarity to Ideal Solution (TOPSIS)

I. INTRODUCTION

Teachers are educators with the main task of educating, teaching, guiding, directing, jasmine, assessing, and evaluating learners in early childhood education formal education, primary education and secondary education. To perform their duties professionally, a teacher not only has educative technical skills, but also must have a reliable personality that becomes a role model for students, family and society (Arisandi, 2016).

Performance appraisal of achieving teachers is deemed necessary to supervise and evaluate teacher's performance in each school so as to improve the professionalism of a teacher and as a reward for teacher performance. There is a need for software specifically to process teacher performance appraisal data more effectively, objectively and efficiently. The

processing of data in the system will produce an objective and effective output with the support of accurate data and models that will be used for data processing.

The model used in the performance appraisal of this achieving teacher uses Technique For Other Reference by Similarity to Ideal Solution (TOPSIS). The TOPSIS method is chosen because TOPSIS is based on the concept that the best-chosen alternative not only has the shortest distance from the ideal solution, but also has the longest distance from the ideal negative solution then the concept is simple, easy to understand, efficient computing, and has the ability to measure relative performance of decision alternatives in a simple mathematical form.

Some of the studies mentioned above prove that TOPSIS method is very suitable in solving various problems thus the need of TOPSIS method developed in this system so that it will simplify the processed data of the performance of achievement teacher achievement based on a specified criterion.

II. LITERATURE REVIEW

There are several literatures using TOPSIS method in problem solving, among others, research by Renato A. Krohling et al (2015) which presents TOPSIS algorithm performance and the results show the effectiveness of reliable TOPSIS method for problem solving. Research by Hatem Ibn-Khader and Emad Abd-Elrahman proposed the TOPSIS method for optimal dissemination of vCDN migration problems. Implementation of TOPSIS method is also done by ZA. Fahmiyati et al (2015) for the selection of used cars by adding a map visualization.

The study presents a model of decision-making by referring to some previous research, between D. M. Khairina et al (2016) study using the concept of decision-making for employee selection and Hamdani et al (2016) study for the palm oil suitability model.

III. TECHNIQUE FOR OTHER PREFERENCE BY SIMILARITY TO IDEAL SOLUTION (TOPSIS) ALGORITHM

TOPSIS (Technique For Others Reference by Similarity to Ideal Solution) is one of the multi criteria decision-making methods introduced by Yoon and Hwang (1981). This method uses the principle that the chosen alternative must have the closest distance from the ideal solution and furthest from the ideal solution from a geometric point of view. The determination of the relative closeness of an alternative with the optimal solution is done by calculating the Euclidean distance. The TOPSIS method considers the distance to a positive ideal solution and a negative ideal solution by taking the value of proximity relative to its ideal positional solution.

The positive ideal solution itself is defined as the sum of all the best attainable values for each attribute, while the negative-ideal solution consists of all the worst values achieved for each attribute. This method is widely used to solve practical decision making. This is because the concept is simple and easy to understand, computing is efficient, and has the ability to measure the relative performance of decision alternatives. Here is the procedure of TOPSIS algorithm:

1. Counting the separation measure
2. Determine the distance between the value of each alternative with the positive and negative ideal solution matrix
3. Determine the preference value for each alternative
4. Decision matrix D refers to the alternative m to be evaluated based on n criteria defined as follows:

$$D = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}$$

X_{ij} denotes the performance of the calculation for the i-th alternative of the jth attribute.

Steps to solve the problem using TOPSIS in making the conclusion:

1. Define the problem to be solved by TOPSIS method
2. Make a decision matrix according to the problem to be solved, then do the normalization matrix with the equation

$$r_{ij} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^m X_{ij}^2}}$$

Where r_{ij} is the resulted matrix of normalization of the basic matrix of the problem, with $i = 1, 2, 3, \dots, m$, and $j = 1, 2, 3, \dots, n$. While x_{ij} is the basic matrix to be normalized. For each show the row of the matrix, and for each row the column of each matrix.

3. Perform normalization of matrix r_{ij} using weight rating to obtain normalized weighted rating matrix, the equation used is as follows.

$$Y_{ij} = w_i \cdot r_{ij}$$

Where y_{ij} is the weighted rating matrix, w_i is the i rating weight, and r_{ij} is the normalized result matrix in step two. For $i = 1, 2, \dots, m$, and $j = 1, 2, \dots, n$. In this case, the rating weights must be determined based on the number of decision variables being completed.

4. Determine the positive ideal solution (A^+) and the ideal solution (A^-) based on the weighted rating matrix value in step 3. The following equations are used to find the ideal solution value and the value of the ideal solution.

$$A^+ = y_1^+, y_2^+, \dots, y_n^+ \\ A^- = y_1^-, y_2^-, \dots, y_n^-$$

Under the condition :

$$Y_i^+ = \max y_{ij} ; \text{if } j \text{ is benefit attribute} \\ \min y_{ij} ; \text{if } j \text{ is cost attribute} \\ Y_i^- = \max y_{ij} ; \text{if } j \text{ is cost attribute} \\ \min y_{ij} ; \text{if } j \text{ is benefit attribute}$$

Determine the distance between the weighted value of each alternative to a positive ideal solution and its negative ideal solution. To determine the distance between the weighted value of each alternative to a positive ideal solution, the following equations are used.

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

To calculate the distance between the weighted value of each alternative to the ideal negative solution, the following equation is used.

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

The last step is to calculate the preference value for each alternative with the equation:

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}$$

IV. RESEARCH METHOD

A. Data Collection

Data obtained through various methods of interview and observation. Interview technique was conducted to obtain the criteria data used / considered in the performance assessment of the achievement teacher and the weight value data as the basic of the beginning of mathematical calculation using TOPSIS algorithm. Observation technique is done to observe directly object that is teacher and activity of teaching-learning

process and to get secondary data in the form of alternative data of decision.

B. Data Criteria and Weight Value

There are 8 (eight) criteria that are used in the performance assessment of the achieving teachers (1) pre-learning; (2) mastery of learning materials; (3) approach / learning strategy; (4) utilization of learning resources / instructional media; (5) learning that triggers and nurtures student involvement; (6) assessment of process and learning outcomes; (7) the use of language; and (8) closing learning activities. Each criterion has an assessment weight determined from the interviews and field observations with relevant sources, can be seen in Table 1.

TABLE I. CRITERIA WEIGHT VALUE

Criteria	Weight Value
Pre-Learning	4
Mastery of subject matter	4
Approach/learning strategy	3
Utilization of learning resources / learning media	2
Learning that triggers and nurtures student involvement	3
Assessment of learning processes and outcomes	3
Language usage	2
Closing Activity Learning	2

Each criterion has several sub criteria as well as parameter values on each criterion and sub criteria parameter as shown in Table 2.

TABLE II. PARAMETER WEIGHT CRITERIA

Parameter Criteria	Weight
Very good	4
Pretty good	3
Less	2
Very less	1

C. Sub Criteria and Parameters of Each Criteria

In 8 (eight) performance assessment criteria of achievement teachers there are sub criteria and parameters of each criteria and weight of each parameter criteria such as:

1. Pre-Learning Parameter (C1)

Parameter criteria 1 pre-learning there are two sub criteria, can be seen in Table 3.

2. Lesson Mastery Subject Parameter (C2)

Parameter criterion 2 mastery of subject matter there are two sub criterion, can be seen in Table 4.

3. Approach/Learning Strategy Parameter (C3)

Parameter criteria 3 approach/learning strategy there are two sub criterion, can be seen in Table 5.

TABLE III. PRE-LEARNING (C1)

	Pre-Learning (C1)	Parameters	Value
a.	Preparing students to learn	Using syllabus and RPP	4
		Have a semester program	3
		Not using syllabus and RPP	2
		Have no preparation	1
b.	Perform Apperception Activities	Giving motivation	4
		Greet the students	3
		Direct assignment	2
		The teacher does not engage in apperception activities	1

TABLE IV. LESSON MASTERY SUBJECT (C2)

	Lesson Mastery Subject (C2)	Parameters	Value
a.	Shows Mastery of learning materials	Present in accordance with the sequence of learning materials	4
		Teaching without looking at books	3
		Teaching using books	2
		Do not use any learning materials	1
b.	Associate material with other knowledge relevant to the reality of life	Linking with manners	4
		Associates with the latest information	3
		Associate with the student's personal life	2
		Not related to anything	1

4. Utilization of Learning Resources/Learning Media Parameter (C4)

Parameter criteria 4 utilization of learning resources/instructional media there is one sub criterion, can be seen in Table 6.

5. Learning Criteria that Trigger and Maintain Student Involvement Parameter (C5)

Parameter criteria 5 learning criteria that trigger and maintain the involvement of students there are three sub criteria, can be seen in Table 7.

TABLE V. APPROACH/LEARNING STRATEGY (C3)

	Approach/Learning Strategy (C3)	Parameters	Value
a.	Implement learning in accordance with the competence (goal) to be achieved	Learning according to syllabus	4
		Learning according to RPP	3
		Learning can reach the indicator	2
		Do not follow the rules of learning	1
b.	Master the class	Creating a fun classroom atmosphere	4
		The classroom atmosphere is orderly	3
		Creating an unpleasant classroom atmosphere	2
		Creating a boring classroom atmosphere	1

TABLE VI. UTILIZATION OF LEARNING RESOURCES/LEARNING MEDIA (C4)

	Utilization of Learning Resources/Learning Media (C4)	Parameters	Value
	Use of instructional media	Using LCDs and books	4
		Using a whiteboard without a book	3
		Explain the crude matter	2
		Do not use instructional media	1

TABLE VII. LEARNING TRIGGERING AND MANTAINING STUDENT INVOLVEMENT (C5)

	Learning Triggering and Maintaining Student Involvement (C5)	Parameters	Value
a.	Grow students' active participation in learning	Grow students' understanding of learning through discussion	4
		Grow students' ability to communicate	3
		Foster a sense of dislike in learning	2
		Grow awkwardness towards students	1
b.	Shows an open attitude towards the student's response	Demonstrate his diligent attitude	4
		Show appreciation	3
		Demonstrates the usual attitude	2
		Showing boredom in learning	1
c.	Foster the cheerfulness and enthusiasm of students in learning	Foster the cheerfulness and enthusiasm of students in learning	4
		Provide motivation to the students for the spirit in learning	3
		Provide motivation to be diligent to school	2
		Growing a sense of laziness in learning	1

6. Assessment of Processes and Learning Outcomes Parameter (C6)

Parameter criteria 6 assessment process and learning outcomes there are two sub criteria, can be seen in Table 8.

7. Language Usage Parameter (C7)

Parameter criterion 7 language use there is one sub criterion, can be seen in Table 9.

8. Activity Closing Parameter (C8)

The criterion parameter 8 activities close the learning there is one sub criterion, can be seen in Table 10.

TABLE VIII. PROCESS ASSESSMENT AND LEARNING OUTCOMES (C6)

	Process Assessment and Learning Outcomes (C6)	Parameters	Value
a.	Monitoring learning progress during the process	The teacher conducts an evaluation to improve and improve the learning and teaching process	4
		Monitoring the learning progress of learners	3
		Monitor student attitudes	2
		Indifferent to student development	1
b.	Conduct a final assessment in accordance with the competence (goals)	Doing pre test and post test	4
		Perform a cognitive assessment	3
		Perform an assessment with the task	2
		Do not make a final assessment	1

TABLE IX. LANGUAGE USAGE (C7)

	Language Usage (C7)	Parameters	Value
a.	Use spoken and written language clearly, well and correctly	Teachers using the Indonesian language according to EYD rules	4
		The teacher uses intonation with the appropriate style	3
		Teachers using local languages sometimes do not	2
		Teachers use the local language	1

TABLE X. LEARNING AND ACTIVITIES (C7)

	Learning End Activities (C8)	Parameters	Value
a.	Reflection and summary of learning	Doing systematic learning reflection	4
		Reflecting on learning by involving students	3
		Just conclude learning materials	2
		Reflecting and not involving students	1

V. RESULTS AND DISCUSSION

A. System Analysis

Performance Appraisal Teacher Performance Using Technique for Other Preference by Similarity to Ideal Solution (TOPSIS) as a computational method. The resulting output is some of the best performing teacher recommendations that can be used as consideration in determining teacher performance appraisal in school. The criteria used in the performance assessment of achieving teachers there are 8 (eight) criteria with each criterion has a weight value and sub criteria along with its parameters. The system has 2 (two) users ie admin and user (principal). The division of access rights between the admin and the normal user that is for the admin have access to alternative teacher data input, the value of the teacher criteria and teacher performance appraisal criteria by logging in first. For normal user access is to assess the performance of teachers by choosing the name of the teacher who want assessed/evaluated and then done the calculation by applying the TOPSIS method. The results of the TOPSIS calculation will be given output in the form of a ranking of some recommendations of teachers with the best performance.

B. System Design

Use Case Diagram Design

Use Case Diagram has 2 actors namely user and admin, presented in Figure 1.

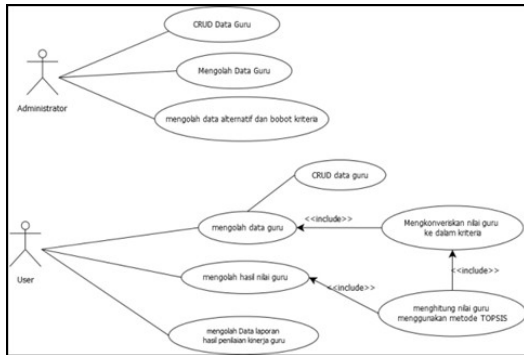


Figure 1. Use Case Diagram of Teacher Performance Assessment

Activity Diagram Design

The design of activity diagram describes the activity of admin (school admins) and user (principal) where admin has 4 branches that can add alternative, edit criteria edit weight and delete teacher data while user login there are 3 branches that is alternative input and criterion, doing calculation TOPSIS performance value of achieving teachers so as to produce outcomes of some outstanding teacher recommendations. The activity diagram can be seen in Figure 2.

C. System Implementation

Implementation is the realization of the system based on the design that has been done. The implementation of the calculation form with the application of TOPSIS method, see Figure 3 where there are 3 buttons are the data load button functions to update the data in the second table and the third table, the count button serves to calculate the final sum in the

fourth table, and the third key serves to view the data as well print reports to view the results of teacher performance recommendations. The TOPSIS process stages are shown in the first data grid view table which is the matrix normalization calculation, the second data grid view table displays the weight of each criterion, the third data grid view table displays the weighted normalization calculation then the fourth data grid view table represents the final value of ranking from the TOPSIS method calculation.

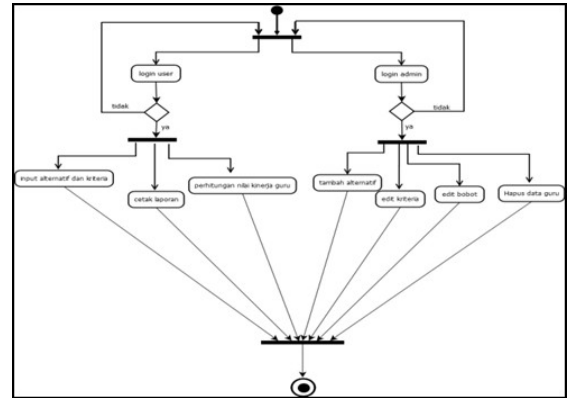


Figure 2. Activity Diagram of Teacher Performance Assessment System



Figure 3. TOPSIS Calculation Form

VI. CONCLUSION

The results of the research have been done, it can be concluded that is produced Decision Support System Performance Appraisal Teacher Performance Appraisal by using Technique Method For Other Preference by Similarity to Ideal Solution (TOPSIS) which is able to give the teacher recommendation for best performance. This system is expected to make it easier for the assessment team to determine the best teacher performance.

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