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Decision Support System Using TOPSIS Algorithm for Teacher Selection

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Abstract

Determining the best teacher to award because of high dedication is very reasonable. Decision support system with TOPSIS method is a method that can be used to conduct alternative selection (teacher) based on the criteria used, the results obtained are not final decisions but in the form of recommendations to leaders to make decisions. The use of the TOPSIS method in producing recommendations to policy makers is very appropriate because this method performs testing in stages and the results are also quite good.

Keywords: *Decision Support System, Selection, TOPSIS, Criteria and Alternative.*

INTRODUCTION

The best teachers are teachers who have the ability to carry out tasks, succeed in carrying out tasks, have personalities that are in accordance with the teaching profession and have educational insights so that they are able to significantly improve the quality of the process and results of learning or guidance that are exceeded by other teachers, colleagues, and the surrounding community[1], [2]. Technically, the selection of outstanding teachers is carried out in stages, starting from the level of the Education Unit, District, Regency / City Province, and national level. In general, the implementation of teacher selection achievements has proceeded smoothly in accordance with the established criteria.

Decision Support Systems (DSS) in the world of education can be seen as important assets to support the smoothness and accuracy in achieving a goal[3]–[8]. One of the characteristics of a decision that can be supported by the DSS is the decision is structured, in the sense of obtaining a decision there are various procedures that must be followed and the criteria for each procedure are clear and quantitative[9], [10]. Decision support system is part of artificial intelligence like a Expert System[11]–[15].

TOPSIS (Technique for Performance Orders by Similarity to Ideal Solution) method[16], [17] is one method of multi-criteria decision making by applying the value weight to each of the criteria[18], [19]. This method uses the principle that the chosen alternative must have the closest distance from the positive ideal solution and the farthest distance from the negative ideal solution. Options will be sorted by value so that the alternative that has the shortest distance with a positive ideal solution is the best alternative. The Decision Support System with the TOPSIS method is one solution that can be used to select outstanding teachers.

METHODOLOGY

Decision support systems are interactive information systems that provide information, modeling, and manipulation of data. The system is used to help decision makers in semi-structured situations and unstructured situations, where no one knows exactly how decisions should be made[20], [21].

Decision support systems are usually made to support solutions to a problem or to evaluate an opportunity. Such decision support systems (DSS) are called DSS applications. DSS applications are used for decision making. The DSS application uses a flexible, interactive and adaptable CBIS (Computer Based Information System) developed to support solutions to specific unstructured management problems[22], [23].

The DSS application uses data to provide an easy user interface and can combine decision maker thinking. Decision support systems are intended to support management in carrying out analytical work in situations that are less structured and with unclear criteria. Decision support systems are not intended to optimize decision making, but provide interactive tools that allow decision makers to carry out various analyzes using available models.

Decision support system is divided into 6 part[3], [4], [10], [24]–[26].

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1. Retrieve Information Elements
   This is the lowest support provided by a decision support system, namely in the form of access relative to information. Suppose the manager intends to find out information about sales data for a particular marketing area.
2. Analyze Entire File
   In this stage, managers are given access to view and analyze files in full. For example, managers can create special reports on inventory valuation by looking at inventory files or managers can get monthly salary reports from payroll files.
3. Prepare Report From Multiple Files
   This kind of support tends to be needed because managers are associated with many activities in a particular moment.
4. Estimate Decision Consequences
   In this stage, managers are possible to see the impact of each decision that might be taken. For example, a manager might enter the price element in a model to see the effect on operating profit.
5. Propose Decision
   Support at this stage is a little more advanced. An alternative decision can be presented to the manager stage to be considered.
6. Make Decision
   This is a type of support that is very applied from SPK. This stage will give a decision that is left waiting for the legitimacy of the manager to be carried out.

Based on the level of technology the decision support system (DSS) is divided into 3 type:

1. Specific DSS
   Specific DSS aims to help solve a problem with certain characteristics. For example, DSS determines the unit price of goods.
2. Generating DSS
   A software specifically used to build and develop DSS. The DSS generator will facilitate the design in building specific DSS.
3. DSS equipment
   In the form of software and hardware that is used or supports the construction of specific SPK and SPK generator.

TOPSIS is one of the multicriteria decision-making methods that was first introduced by Yoon and Hwang (1981). TOPSIS is based on a concept, where a good chosen alternative not only has the shortest distance from a positive ideal solution, but also has the longest distance from a negative ideal solution. The concept is simple and easy to understand, its computation is efficient and has the ability to measure the relative performance of decision alternatives in a simple mathematical form[4], [9], [26], [27].

The principle of the TOPSIS Method is simple, where alternatives are chosen in addition to having proximity to positive ideal solutions and away from negative ideal solutions. The ideal solution is formed if as a composite the best performance values are displayed by each alternative for each attribute. The ideal negative solution is a combination of the worst performance values. The distance to each pole of performance is measured in the Euclidean sense, with optional weights of each attribute. This concept is widely used in several MADM models to solve decision problems in a practical manner. In general, the procedure of the TOPSIS method follows the steps as follows:

1. Determine normalized decision matrices

$$R_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}}$$

2. Calculate weighted normalized decision matrices

$$W = w_1, w_2, w_3, \ldots w_n,$$

$$V_{ij} = w_j . R_{ij}$$

3. Calculates the matrix of positive ideal solutions and matrix ideal negative solutions

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

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

4. Calculate the distance between the values of each alternative with a matrix of positive ideal solutions and a matrix of negative ideal solutions

   The distance between alternative A1 and positive ideal solutions is formulated as:

$$D_1^+ = \sqrt{\sum_{j=1}^{n} (y_1^+ - y_{ij})^2};$$

   the distance between alternative A1 and negative ideal solutions is formulated as:

$$D_1^- = \sqrt{\sum_{j=1}^{n} (y_1^- - y_{ij})^2};$$

5. Calculate preference values for each alternative

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

RESULT AND DISCUSSION

Determination of teacher achievement is an activity carried out to award as a reward for dedication during the teaching and learning process, the determination of teacher achievement has been done manually for the assessment process, assessment of outstanding teachers has several criteria including Written Test, Interview Test, Teaching Presentation, English & ICT.

Table 1. Pairing Matrix

Alternative/ Criteria	C1	C2	C3	C4
A1	1	3	2	3
A2	0.33	1	2	2
A3	0.5	0.5	1	3
A4	0.33	0.5	0.33	1
Total	2.16	5	5.33	9

Fill the matrix elements in Table 1 is as follows:

a. Element a [i, j] = 1, where i = 1,2,3, ... n. For this study, n = 8. b. The upper triangle matrix element as input.

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b. The lower triangle matrix element has the formula a [j, i] = 1 for i ≠ j. a [[i, j]
c. Add up each column in Table 1.
From the value of the criteria matrix element above, the number of elements for each column is:
Number of Columns 1: 1 + 0.33 + 0.5 + 0.33 = 2.16
Number of Columns 2: 2 + 1 + 0.5 + 0.5 = 5
Number of Column 3: 2 + 2 + 1 + 0.33 = 5.33
Number of Columns 7: 3 + 2 + 3 + 1 = 9
d. Divide each element in the column by the appropriate number of columns. From the values of matrix elements table 4.2. The number of each column above can be calculated by normalizing the matrix by dividing each element in the column by the appropriate number of columns for example to calculate the normalization matrix in columns 1 and row 1.

Table 2. Normalization Results

Alternative/Criteria	C1	C2	C3	C4	Total
A1	0.44	1.33	0.89	1.33	4.99
A2	0.08	0.24	0.48	0.48	1.28
A3	0.11	0.11	0.21	0.689	1.07
A4	0.03	0.05	0.03	0.11	0.22

e. After the normalization matrix is obtained, the next step adds up each row in the matrix. The number of each row in table 4.3 can be calculated as follows.
Number of Lines 1 = 0.44 + 1.33+ 0.89+ 1.33 = 4.99, and so on.
f. After getting the number of each row, then the weight of each criterion is calculated by dividing each number of rows by the number of elements or number of criteria (n = 4), so that the weight of each criterion can be calculated as follows:
Weight of C1 = 4.99 / 4 = 0.99
Weight of C2 = 1.28 / 4 = 0.32
Weight of C3 = 1.07 / 4 = 0.26
Weight of C4 = 0.22 / 4 = 0.05

CONCLUSION

Analysis of the TOPSIS method carried out in the process of selecting outstanding teachers was able to select well based on existing criteria with predetermined alternatives. The TOPSIS method in this process produces alternatives based on positive and negative ideal values until the best results from the process are obtained.

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