Comparison Of AHP And Topsis Methods In Determining Scholarships For Elementary School Students

Efansius Tarigan[1]*, Poningsih[2], Muhammad Ridwan Lubis[3], Solikhun[4], Dedi Suhendro[5]

[1]STIKOM Tunas Bangsa Pematangsiantar, North Sumatra, Indonesia
[2,3,4,5]AMIK Tunas Bangsa Pematangsiantar, North Sumatra, Indonesia
*efantarigan622@gmail.com

Abstract

The regional coordinator of the Siantar sub-district is the education office in the Siantar sub-district. The office is used to store elementary school student data in the Siantar sub-district before it is submitted to the education office in Simalungun district. In collecting data on students in each school, employees sometimes find it difficult to filter out which students have the highest grades in each elementary school and determine who deserves assistance from the Simalungun Regency Government for those who excel. Therefore, the comparison of the AHP and TOPSIS methods in determining the scholarships for elementary school students at the Siantar District Regional Coordinator is to carry out a ranking of alternatives in the form of student data. The AHP and TOPSIS methods are compared because this method determines the weight value for each attribute, which is followed by ranking a number of available options and then reselected to find the best choice

Keywords: *Education, AHP, Topsis, Scholarship*

1. Introduction

Siantar District Education Coordinator or Regional Coordinator for Education Siantar District Simalungun Regency is an Indonesian Government Education Institution which has the task of supervising elementary schools. The District Education Coordinator as data storage for teachers and students in all areas of Siantar- Simalungun Regency. The District Education Coordinator is also a place for screening the values of students who will be brought to the education office. So that the value obtained from several students in each school is only as data in the form of grades and attendance from some students who are attached to the Education Office without filtering them directly from the results of the learning process. This becomes constrained in the selection of outstanding students from the education office, so that recipients of assistance or scholarships to students are sometimes inaccurate or misdirected. Research related to the comparison of the AHP and TOPSIS methods has been carried out by [1] namely the Comparative Analysis of the Ahp and Topsis Methods in the Selection of Laboratory Assistants at Fkom Uniku, Based on previous research using the AHP and TOPSIS methods as decision support as stated in the introduction that the method TOPSIS has a greater level of accuracy than the AHP method[2],[3],[4], although in each case there are differences in the number of criteria and alternatives.

Research related to the AHP and TOPSIS methods has been carried out by [5],[6]The Decision Support System for Determining the Best Employees Using the Ahp and Topsis, the Methodmethod AHP and TOPSIS. A trial was conducted in the form of entering sample data of 300 employees and then it was successfully processed within 0.9531 seconds so that it was proven that this system performed calculations faster than before. Research related to the comparison of the AHP and TOPSIS methods has been carried out by [7] namely Comparative Analysis of AHP and Topsis Methods in a Decision Support System for Food Menu Selection for Children Post-Operation. Hisphrung Web-BasedAHP and TOPSIS can be applied to determine food menu recommendations.

Research related to the AHP and TOPSIS methods has been carried out by [8] Namely the New Employee Admissions Decision Support System using the AHP and TOPSIS Methods, that changes in the value of the comparison matrix in the method AHP does not really affect the final calculation results of the system or in other words there is no significant change to the final results of the calculation of the AHP and TOPSIS methods. Therefore, the author will conduct a study to compare the AHP and TOPSIS methods. In this study, based on the case above, the authors took the initiative to compare the AHP method with TOPSIS, to find out whether the results given by the AHP and TOPSIS methods were the same or experienced different results[9],[10] and from the level of accuracy of the information provided, which method was able to provide information. which is more accurate. It is very necessary to know the Government's plan, especially in the field of Education in helping students who have a high interest in learning and provide assistance in the form of scholarships to those who have scholarships from an early age.

2. Research methodology

The research methodology provides an overview of the process or procedure used by the author to solve the problem. The method used in this research is the AHP method and the TOPSIS method. This study was conducted to compare the accuracy of the AHP and TOPSIS methods. The data collection used by researchers in obtaining comparative data is by sampling. Sampling is the collection of data that partially or represents all the characteristics of the population. The data taken by the author in this study were Dapodik and grades of elementary school report cards. The results obtained in research conducted by the author to determine the level of accuracy and efficien-

cy of the two methods. Design of This research design will discuss the research design workflow used for the process that will be built to compare AHP and TOPSIS below:
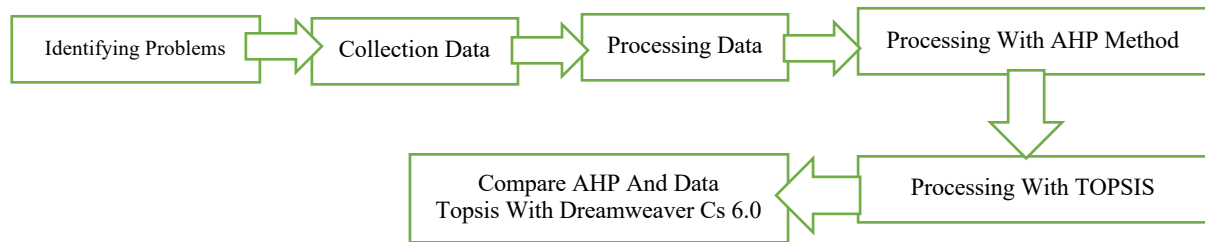
Figure 1. Research Framework

From Figure 1 The steps of research work can be explained as Problem Identification is analyzing problems related to the assessment of students in elementary schools. In this study, the criteria were elementary school assessments in 2020. Collection data were obtained from dapodik data and elementary school report cards received from the Regional Coordinator for Education. Data Processing will be processed so that it can be used. Processing Data Using the AHP Method, Processing Data With TOPSIS and Comparing AHP and TOPSIS Data.

3. Results and Discussion

Contains a view of the execution or implementation of the system that has been created. The following shows the results and website-based implementation using the AHP and TOPSIS algorithms.

3.1. Manual Calculation of AHP Method

To get the results of the research conducted, problem solving must be done by manual calculation using the AHP method, after doing manual calculations it must be tested on the application. The data that will be used for the process of ranking the values of the Dapodik in 2021 here the authors take the total value of report cards, attendance and income of parents in elementary schools. The following is the process the author does in classifying student assessment data. The most important part of the analysis process is the following 3 (three) stages: Average Value of Report (NR), presence (AB) and Income of parents (PO).
Determining the Comparison of Criteria Matrix:

    a.   Develop criteria for determining the value of pairwise comparison matrices.

Table 1. Making a Comparison Matrix for Each Criteria

Criteria	NR	AB	PO
NR	1	3	5
AB	0,33	1	0,2
PO	0,2	0,6	1
Total	1,53	4,60	6,20

    b.   Creating a Criteria Value Matrix
    After the data has been compiled into the paired table above, a criterion value matrix will be created by means of the NR and NR columns in table 1 divided by the number of columns and so on:

Table 2. Matrix of Criteria Value

Criteria	NR	AB	PO	Amount	Priority
NR	0,65	0,65	0,81	2,11	0,70
AB	0,22	0,22	0,03	0,47	0,16
PO	0,13	0,13	0,16	0,42	0,14

    c.   Creating a Sum Matrix for Each Row
    Multiplying the number of priority columns in table 2 by the number of rows in table 1 by producing table 3 as follows:

Table 3. Matrix of Criteria Value

Criteria	NR	AB	PO	Amount
NR	0,70	0,47	0,70	1,87
AB	0,33	0,16	0,03	0,52

PO	0,20	0,09	0,14	0,43

d. Calculation of the Consistency Ratio
In the calculation of the sum of the ratios obtained from the division of the number of results from table 3 with priority in table 2 and produces the number of ratios in table 4 below:

Table 4. Matrix Value Criteria

Criteria	Number of rows	Priority	Results
NR	1,87	0,70	2,66
AB	0,52	0,16	3,32
PO	0,43	0,14	3,09
Amount			9,07

e. Making Consistency Ratio Calculations

Table 5. Matrix Value Criteria

1	summation	9,07
2	N	3
3	Max(Amount/n)	3,02
4	C1 (Amount - n)	0,02
5	C1 (n - 1)	2
6	C1 (Amount/n)	0,01
7	IR	0,85
8	CR (C1/IR)	0,01

Information:
1. The sum value is taken from table 3,4
2. The N value is obtained from the number of criteria used, namely the value of report cards, attendance and parental income.

$$Max = \frac{number\ of\ criteria\ values}{n}$$

$$= \frac{9,007}{3}$$

$$Max = 3,02$$

$$
\begin{aligned}
C1 \quad &= Amount - N \\
&= 3,02 - 3 \\
&= 0,02
\end{aligned}
$$

$$
\begin{aligned}
C1 \quad &= N - 1 \\
&= 3 - 1 \\
&= 2
\end{aligned}
$$

$$C1 = \frac{number\ of\ criteria\ values}{n}$$

$$C1 = \frac{number\ of\ criteria\ values}{n}$$

$$C1 = \frac{0,02}{2}$$

$$C1 = 0,01$$

3. IR is obtained from the value that has been determined in the following table:

Table 6. Random index (RI)

N	1,2	3	4	5	6	7	8	9	10	11	12	13	14	15
RI	0.00	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

f.   Matrix of Comparison of Report Card Pairs
    Determining MatrixComparison Report Card Couple

Table 7. Matric Results Normalization Criteria

Criteria	Special	good	enough
Special	1	5	7
good	0,20	1	0,14
enough	0,14	0,7	1
Amount	1,34	6,71	8,14

Creating Report Card Matrix Values

Table 8. Results Of The Normalization Matrix Criteria

Criteria	Special	Good	Enough	Amount	Priority
Special	0,74	0,74	0,86	2,35	0,78
good	0,15	0,15	0,02	0,32	0,11
enough	0,11	0,11	0,12	0,34	0,11

Creating a Sum Matrix for Each Row of Report Cards

Table 9. The results of the normalization matrix criteria

Criteria	Special	Good	Enough	Amount
Special	0,78	0,53	0,78	2,09
good	0,20	0,11	0,02	0,32
enough	0,14	0,08	0,11	0,33

Calculation of the Consistency Ratio of Report Cards

Table 10. Results of the matrix normalization criteria for

Kriteria	Number Of Rows	Priority	Result
Special	2,09	0,78	2,67
Good	0,32	0,11	3,05
Enough	0,33	0,11	2,95
	Amount		8,67

Making Consistency Ratio Calculations

Table 11. The results of the normalization matrix of criteria

1	summation	8,67
2	N	3
3	Max(Amount/n)	2,89
4	C1 (Amount - n)	-0,11
5	C1 (n - 1)	2
6	C1 (Amount/n)	-0,05
7	IR	0,85
8	CR (C1/IR)	-0,06

If the value is 0.1 then the result is consistent

g. Comparison Matrix of Attendance Pairs
Pair Comparison Matrix determine Attendance

Table 12. Results of the normalization matrix criteria

Criteria	Special	Good	enough
Special	1	3	7
Good	0,33	1	0,14
Enough	0,14	0,4	1
Amount	1,48	4,43	8,14

Creating Attendance Matrix Values

Table 13. Result of normalization matrix criteria

Kriteria	Special	Good	Enough	Amount	priority
Special	0,68	0,68	0,86	2,21	0,74
Good	0,23	0,23	0,02	0,47	0,16
Enough	0,10	0,10	0,12	0,32	0,11

Creating a Matrix for the Sum of Each Attendance Row

Table 14. Results of the normalization matrix criteria

Kriteria	Special	Good	Enough	Amount
Special	0,74	0,47	0,74	1,95
Good	0,33	0,16	0,02	0,50
Enough	0,14	0,07	0,11	0,32

Calculation of the Attendance Consistency Ratio

Table 15. The results of the normalization matrix criteria for

Criteria	number of rows	Priority	Result
Special	1,95	0,74	2,64
Good	0,50	0,16	3,23
Anough	0,32	0,11	2,99
	Amount		8,85

After entering the student data, it can be determined the results of the desired criteria for each student

Table 16. The results of the arrangement of student data

No	Name	Report Score	Criteria	
			Attendance	Income
1	Adlys namora nainggolan	Well	good	good
2	Aisyah Nur Alifa	Well	good	very good
3	Aldi pratama girsang	Well	very good	good
4	Angel injel silaen	Well	enough	very good
5	Aulya risky ambaroudah	Well	good	very good
….	……………….	………	………	………..
29	Zahara maharani princess lubis	Well	enough	good

After being grouped, the results of completing student data will be carried out in the following table:

Table 17. Final Results

No	Name	criteria			Amount
		Report Score	Attendance	Parent's Income	
1	Adlys namora nainggolan	0.5193710	0.02434614	0.014839174	0.5585564
2	Aisyah Nur Alifa	0.5193711	0.02434614	0.015740605	0.5594578

3	Aldi pratama girsang	0.5193711	0.01574061	0.014839174	0.5499509
4	Angel injel silaen	0.5193711	0.0185553	0.015740605	0.5469672
5	Aulya risky ambaroudah	0.5193711	0.02434614	0.015740605	0.5594578
…..	……………….	………….	…………….	…………….	………
29	Zahara maharani princess lubis	0.5193711	0.0185553	0.014839174	0.5460658
				min	0.5460658
				max	0.6758316
				average	0.5620146

3.2. TOPSIS Method

To get the results of the research conducted, problem solving must be done manually using the TOPSIS method. The calculation using the TOPSIS method is carried out with the same sample data and weighting as the AHP method. To get the results of the research conducted, problem solving must be done manually using the TOPSIS method. The calculation using the TOPSIS method is carried out with the same sample data and weighting as the AHP method.

Table 18. Matrix of weighted values

Priority	NR	AB	PO
Main priority	0.70	0.16	0.14
NR priority	Very good	Very good	Very good
	0.78	0.11	0.11
AB priority	Well	Well	Well
	0.74	0.16	0.11
PO priority	Enough	Enough	Enough
	0.76	0.16	0.08

The results of the Reference Value of Each Alternative can be seen in the following table:

Table 19. Results of Reference Values for Each Alternative

No	Name	Reference Value
1	Adlys namora nainggolan	0.01735963
2	Aisyah Nur Alifa	0.01735963
3	Aldi pratama girsang	0.003654822
4	Angel injel silaen	0.016162615
5	Aulya risky ambaroudah	0.01735963
….	……………...	………….
29	Zahara maharani princess lubis	0.016162615

4. Conclusion

Obtained 3 criteria that measure the assessment of student scholarships, namely grades (k1), attendance (k2), and parental income (k3). From the TOPSIS results, the highest scores were Jevania arta sari manurung 0.999971715, Ruth celcilia lubis 0.999971715, Sarah paulita sagala 0.999971715, Wasty abitha simanjuntak 0.999971715. With a positive/negative ideal solution distance to each alternative. While the AHP produced the highest score, namely Adly namora nainggolan 0.102, Aisyah nur alfa 0.093, Aldi pratama manurung 0.077, Angel silaen 0.069, Aulya risky ambaroudah 0.063. By obtaining an alternative comparison to the C1 criterion, the alternative comparison to the C2 criterion, the alternative comparison to the C3 criterion, then the results are obtained based on the eigen data that has been determined. By comparing the two methods, it can be concluded that the TOPSIS method is easier to use than the AHP method, because the TOPSIS is based on the weighted criteria and alternative values, while the AHP must make a comparison of each criterion and alternative data needed.

Acknowledgement

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