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The Selection of Outstanding Teacher Analysis at SD Negeri 01 Perigi Using TOPSIS Method

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Abstract – Teacher is an important part in the process of teaching and learning activities with students. A teacher can be declared an achiever if he is able to complete the assigned task charged such as: teaching in class, personality and attendance. At the moment, SD Negeri 01 Perigi has 25 permanent teachers, and usually to chose the best teacher candidate uses a subjective judgments standards which is based on the closeness of teacher personnel. For this reason, further analysis is needed to overcome the subjectivity of the procedure selection of outstanding teachers by the principal as the decision maker. TOPSIS method is used to solve the problem . The TOPSIS method will rank the final results of the selected alternatives which calculate the positive ideal distance and negative ideal distance. Criteria set at this research is used as a weighting that is Teacher Evaluation Value, Absence, Discipline, Technology Proficiency, Learning Innovation, and Pedagogic then matrix calculations are carried out which will produce the ranking order that will be selecting the best alternative from a number of alternative solutions. The results of this research are produced 10 sequences outstanding teachers in the order of Wahyuni Fitri Anita (0.923838), Arbaini (0.828896), Abdul Qodir(0.789324), Panji Wahyu Utomo (0.779973), Tuti Supriyati (0.777795) , Rista Milla Karmella (0.773156), Een Wahyuni (0.756624), Nita Susanti (0.697743), Syifa Habibah(0.666821), and Riana Arista(0.62586). The use of the TOPSIS method can assisting the Principal of SD Negeri Perigi 01 in providing recommendations for selection of outstanding teachers objectively at SD Negeri Perigi 01.

Keywords – Decision Support System, TOPSIS, Outstanding Teacher Selection

I. INTRODUCTION

A teacher is a professional educator with the main task of educating, teaching, guiding, directing and evaluating students in early childhood education through formal education, primary and secondary education. The role of the teacher is very influential on the smooth teaching and learning of students. In providing teaching and education to students, a teacher must have a special way so that the teaching given can be accepted and able to be captured by students. In providing material, teachers are required to be able to open their students' insights and enthusiasm for learning both online and offline and the teacher must always monitor students in detail and precisely so that students can easily understand the material presented by the teacher [1]. The burden of a teacher is very heavy because he is a figure that must be emulated by students who play a very important role in the process of building the civilization of a nation with graduates of quality and good morals.

As an effort to give awards to teachers, schools certainly need to give awards to outstanding teachers who have contributed their thoughts and energy, and as a means of competition for teachers to be able to maintain and improve their performance at school.

This research was conducted at SD Negeri 01 Perigi South Tangerang, where based on interviews with the school, that so far the school does not have certain and standard assessment criteria for deciding teachers who excel in school, decision-making in the assessment is still based on subjectivity, namely based on the recognition factor only socially and closeness factors, so that this can motivate other teachers. For this reason, a solution is needed to overcome this problem, namely by analyzing the TOPSIS method to determine outstanding teachers, where the final results will provide a rating recommendation from outstanding teachers based on the weight value of the criteria used in the calculation. The method used in this study is the Technique For Order Of Preference By Similarity To Ideal Solution (TOPSIS), where this method results in a decision making with a multi-criteria problem approach with the results of the selected alternative solutions must be seen from the solution factor the closest positive distance and the farthest negative distance in order to get the best alternative solution and TOPSIS has a better level of accuracy compared to some of its predecessor methods [2]. The TOPSIS method was chosen as the method in this study because according to several previous studies it was stated that the TOPSIS method was suitable and could be implemented to provide recommendations for the best teachers in schools[3],[4],[5]. Previous research discussed about teacher evaluation based on performance using the TOPSIS method. The problem in this study lies in teacher assessment so far being subjective so a system is needed to overcome it. The results of the application of TOPSIS stated that TOPSIS could be used as a tool in making decisions about the best teacher[6],[7]. The second research discusses the selection of tertiary institutions using the TOPSIS method, where the problem raised in this study is the selection of tertiary institutions for high school students as prospective students where most of the selection of tertiary institutions is only based on the words of friends or even just following friends so the authors conducted research related to this problem. The results of applying TOPSIS in this study state that the TOPSIS method can fulfill the objectives because the calculation results can assist prospective students in choosing a tertiary institution[8]. Follows by research about choosing the right land for oil palm plantations using the TOPSIS method [9]. The problem in this research is to find the right land for oil

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palm plantations so that the planted oil palm plants can grow optimally so that they can produce high quality coconut oil. The result of applying TOPSIS in this study is that the TOPSIS method can produce the best alternative based on the shortest distance from the positive ideal solution and the farthest from the perfect negative solution. Another study discusses the selection of outstanding teachers at SMK Negeri 1 Pantai Labu using the TOPSIS method[10]. In this study the authors conducted a ranking in finding outstanding and underachieving teachers using the TOPSIS method. Based on the calculation of the criteria weight, it can be concluded that the TOPSIS method can be used in an effort to determine outstanding and underachieving teachers. Research of an assessment of the best employees at the Hidayah Purwokerto General Hospital using the TOPSIS method[11]. The test results from this study indicate that TOPSIS can be implemented in determining the best employees.The sixth research discusses the acceptance of new employees at SMA Al Waliyah Tanjung Morawa [12],[13],[14]

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II. RESEARCH METHODOLOGY

2.1Research Data Collection Method

According to Sugiyono[15] one of the techniques that can be used in collecting data is to collect primary data. Primary data is a source of data obtained directly from the SDN 01 Perigi school. Data collection in this study was carried out using direct interview techniques with decision makers, namely the Principal of SD Negeri 01 Perigi, Tangerang, to obtain primary data, namely the original data needed for this research. From the results of the interviews, a list of names were given which would be alternative data candidates to be used in the study. Based on the results of interviews there were around 25 teachers at the school.

2.2 Population and Research Sample

Sugiyono[15] means that a population is taken from a place or area which can consist of an object that has certain characteristics determined by the researcher to be used in the research being carried out. The population and research sample are the total number of research objects that will be involved in a study. In this study, the object of research is the teacher. The total number of teachers at SD Negeri 01 Perigi, Tangerang is 25, with demographic details as follows:

Table I. Teacher Demographics

No	Gender	Total
1	Male	9
2	Female	16
Total		**25**

Based on Table 1, a total of 25 teachers were obtained, the number of teachers that will be used in this study as an alternative value.

2.3 Data Analysis Method

1. **T**he method used is the TOPSIS method or known as *Technique For Others Reference by Similarity to Ideal Solution*. Based on the data obtained, in research conducted at SD Negeri 01 Perigi, several research criteria were used to find outstanding teachers, namely:

Table II. Assessment

Criteria	Information
C1	Teacher Evaluation Value
C2	Absence
C3	Technology Proficiency
C4	Learning Innovation
C5	Pedagogic

Alternative solutions used in this study are a number of 25 teachers with the following description:

Table III. Table of Alternative Solutions

Alternative	Names
A1	NITA SUSANTI,S.Pd SD
A2	EEN WAHYUNI S.Pd SD
A3	TUTI SUPRIYATI, S.Pd SD
A4	WAHYUNI FITRY ABITA, S.Pd
A5	RIANA ARISTA
A6	SITI AISAH
A7	ROMENIH,S.Pd SD
A8	SYIFA
A9	UMI KULSUM,S.Pd
A10	NAWIYAH,S.Pd
A11	SURYANI JAYA,SE
A12	PANJI WAHYU UTOMO
A13	LILA SAKILLA,S.Pd SD
A14	NURBAITI,S.Pd SD
A15	HJ.SITI RUPIATUN, S.Pd

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A16	SANTI KOMALAWATI,S.Pd
A17	RISTA MILA KARMELIA, S.Pd
A18	DEDEH MAOLIDAH S.Pd SD
A19	NUR HASANAH,S.Pd
A20	ARBAINI,S.Ag
A21	ABDUL QODIR, M.Ag
A22	UUS HUSNA, S.Ag
A23	DEDEN SAPUTRA,S.Pd
A24	DEDE ROBIATUL
A25	LUTHFIAH

3. Hwang and Yoon developed a technique for solving *Multicriteria Decision Making* problems known as the TOPSIS method. To support the *Euclidean* distance, they propose PIS and NIS and each criterion needs to be maximized or minimized. They claim that the TOPSIS method helps sort the closeness of alternatives based on the optimal ideal solution and obtain the maximum level of available alternatives. The following are the steps and calculation formulas for calculating the TOPSIS method based on the decision support system book [16] namely:

A. Creating a matrix that has been normalized based on criteria and alternatives

In this first step, normalization is carried out on the matrix that has been built previously based on the criteria and alternative values. As for this stage, an assessment of the performance of each alternative is required against the criterion value.

$$rij = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{m} X_{ij}^2}} \quad \text{.....(1)}$$

Where the value of r_{ij} is the matrix normalization value, the value of x_{ij} is the value of the weight of the jth criterion in the ith alternative, the i value is the ith alternative value, and the j value is the jth criterion value.

B. Create a weighted matrix normalization

$$Y = \begin{pmatrix} y_{11} & y_{12} & y_{1j} \\ y_{21} & y_{22} & y_{2j} \\ y_{i1} & y_{i2} & y_{ij} \end{pmatrix} \text{ for yij = wj.rij.....(2)}$$

Where the value of Wj is the weight value of the j-criteria, and the value of Yij is the value of the 3-normalized decision matrix

.

C. Determine positive ideal solutions and negative ideal solutions

$$A^+ = (y_1^+, y_2^+, ...y_i^+)$$
$$A^- = (y_1^-, y_2^-, ...y_i^-) \quad \text{.....(3)}$$

Where:

$y_j^+ =$ max yij, if j is *benefit* where is min yij, if j is attribute *cost*

$y_j^- =$ min yij, if j is *benefit* and max yij value, if j is attribute *cost*

D. Determine the distance between (D+) and (D-) to determine positive and negative solutions

$$D_i^+ = \sqrt{\sum_{i=1}^{n} (y_i^+ - y_{ij})^2} \text{ ; i=1,2, ...m.....(4)}$$

$$D_i^- = \sqrt{\sum_{i=1}^{n} (y_{ij} - y_i^-)^2} \text{ ; i=1,2, ...m.....(5)}$$

E. The last step is to determine the preference value for each alternative

$$Vi = \frac{D_i^-}{D_i^- + D_i^+} \text{ ; i=1,2,..m.....(6)}$$

Where a larger Vi value indicates alternative priority

III. RESULTS AND DISCUSSION

The results of the research which describe the calculation stages of the TOPSIS method based on data obtained at the research location, namely SD Negeri 01 Perigi, which was given by the Principal.

3.1 TOPSIS Calculation Results

In this study, based on some of the previous research literature, and based on the results of discussions with the Principal of SDN 01 Perigi Tangerang, it was decided to use 5 criteria and weights, namely as shown in table IV

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Table IV .Criteria and Weight Assessment

Criteria	Description	Cost/Benefit	Weight
C1	Teacher Evaluation Score	Benefit	4
C2	Absence	Benefit	5
C3	Technology Proficiency	Benefit	4
C4	Learning Innovation	Benefit	3
C5	Pedagogic	Benefit	3

A. Assessment based on alternatives and criteria

At this stage calculations are carried out using the TOPSIS method , the first step in starting the calculation is to evaluate each alternative data that is owned with each of the existing criteria, which can be seen in the table below

Table V Assessment Based On Criteria and Alternative

Alternatif / Kriteria	(C1)	(C2)	(C3)	(C4)	(C5)
A1	89	98	80	87	82
A2	87	98	85	87	80
A3	87	96	87	87	82
A4	86	98	95	94	82
A5	82	87	90	90	80
A6	82	85	87	86	80
A7	84	90	80	80	80
A8	89	85	95	92	82
A9	84	95	78	80	80
A10	82	85	78	80	80
A11	80	90	75	78	78
A12	84	95	95	85	78
A13	84	85	90	85	78
A14	82	70	80	78	78
A15	82	90	78	80	80
A16	80	85	78	78	78
A17	86	90	95	92	84
A18	80	87	80	80	75
A19	80	90	85	87	80
A20	86	95	90	90	84
A21	84	95	90	89	80
A22	83	89	87	85	80
A23	79	70	80	78	75
A24	78	85	80	78	75
A25	82	85	95	85	78

B.Normalized Calculation Matrix

Table VI .Normalized Matrix

Matrix Normalization					
Alternatives	C1	C2	C3	C4	C5
A1	0,21360	0,22020	0,18698	0,20570	0,20604
A2	0,20880	0,22020	0,19867	0,20570	0,20101
A3	0,20880	0,21571	0,20334	0,20570	0,20604
A4	0,20640	0,22020	0,22204	0,22225	0,20604
A5	0,19680	0,19548	0,21036	0,21279	0,20101
A6	0,19680	0,19099	0,20334	0,20333	0,20101
A7	0,20160	0,20222	0,18698	0,18915	0,20101
A8	0,21360	0,19099	0,22204	0,21752	0,20604
A9	0,20160	0,21346	0,18231	0,18915	0,20101
A10	0,19680	0,19099	0,18231	0,18915	0,20101
A11	0,19200	0,20222	0,17530	0,18442	0,19599
A12	0,20160	0,21346	0,22204	0,20097	0,19599
A13	0,20160	0,19099	0,21036	0,20097	0,19599
A14	0,19680	0,15728	0,18698	0,18442	0,19599
A15	0,19680	0,20222	0,18231	0,18915	0,20101
A16	0,19200	0,19099	0,18231	0,18442	0,19599
A17	0,20640	0,20222	0,22204	0,21752	0,21106
A18	0,19200	0,19548	0,18698	0,18915	0,18845
A19	0,19200	0,20222	0,19867	0,20570	0,20101
A20	0,20640	0,21346	0,21036	0,21279	0,21106
A21	0,20160	0,21346	0,21036	0,21043	0,20101
A22	0,19920	0,19998	0,20334	0,20097	0,20101
A23	0,18960	0,15728	0,18698	0,18442	0,18845
A24	0,18720	0,19099	0,18698	0,18442	0,18845
A25	0,19680	0,19099	0,22204	0,20097	0,19599

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C. Weighted Normalization Matrix

The next step is to calculate the Weighted Normalization Matrix where each alternative value is taken from the criterion weight value multiplied by the normalization result, the following is the formula for weighted normalization calculations

Table VII .Weighted Normalization

Alternative	Weighted Normalization				
	C1	C2	C3	C4	C5
A1	0,85441	1,10102	0,74795	0,61711	0,61812
A2	0,83521	1,10102	0,79469	0,61711	0,60304
A3	0,83521	1,07855	0,81339	0,61711	0,61812
A4	0,82561	1,10102	0,88819	0,66676	0,61812
A5	0,78721	0,97743	0,84144	0,63839	0,60304
A6	0,78721	0,95496	0,81339	0,61001	0,60304
A7	0,80641	1,01114	0,74795	0,56745	0,60304
A8	0,85441	0,95496	0,88819	0,65257	0,61812
A9	0,80641	1,06731	0,72925	0,56745	0,60304
A10	0,78721	0,95496	0,72925	0,56745	0,60304
A11	0,76801	1,01114	0,70120	0,55327	0,58797
A12	0,80641	1,06731	0,88819	0,60292	0,58797
A13	0,80641	0,95496	0,84144	0,60292	0,58797
A14	0,78721	0,78644	0,74795	0,55327	0,58797
A15	0,78721	1,01114	0,72925	0,56745	0,60304
A16	0,76801	0,95496	0,72925	0,55327	0,58797
A17	0,82561	1,01114	0,88819	0,65257	0,63319
A18	0,76801	0,97743	0,74795	0,56745	0,56535
A19	0,76801	1,01114	0,79469	0,61711	0,60304
A20	0,82561	1,06731	0,84144	0,63839	0,63319
A21	0,80641	1,06731	0,84144	0,63129	0,60304
A22	0,79681	0,99990	0,81339	0,60292	0,60304
A23	0,75841	0,78644	0,74795	0,55327	0,56535
A24	0,74881	0,95496	0,74795	0,55327	0,56535
A25	0,78721	0,95496	0,88819	0,60292	0,58797

D. Positive and Negative Ideal Solutions

Table VIII .Positive and Negative Ideal Seolution

	C1	C2	C3	C4	C5
A+	0,85441	1,1010	0,88812	0,6667	0,63319
A-	0,74881	0,7864	0,70126	0,5532	0,56535

E. Calculation Results of Ideal Solution Distance D+ and D-

Table IX .Ideal Solution Distance

Alternatives	D+	D-
A1	0,149533	0,345189
A2	0,111733	0,347363
A3	0,095711	0,335021
A4	0,032508	0,394318
A5	0,15391	0,257461
A6	0,188603	0,217031
A7	0,202041	0,24003
A8	0,147514	0,295232
A9	0,198677	0,290888
A10	0,248757	0,179676
A11	0,255801	0,226648
A12	0,097781	0,346625
A13	0,178724	0,233157
A14	0,371576	0,064586
A15	0,220515	0,233179
A16	0,262649	0,173398
A17	0,095441	0,325294
A18	0,238474	0,198075
A19	0,16631	0,255137
A20	0,070397	0,341033
A21	0,088274	0,330732
A22	0,155309	0,253661
A23	0,381216	0,047723
A24	0,263882	0,174887
A25	0,178798	0,260415

F. Calculating the Preference value

Table X Preference Value

Alternatif	V
A1	0,697743
A2	0,756624
A3	0,777795
A4	0,923838
A5	0,62586
A6	0,535041
A7	0,542967
A8	0,666821
A9	0,594176
A10	0,419379
A11	0,469787
A12	0,779973
A13	0,56608
A14	0,148077
A15	0,513957
A16	0,397659

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Alternatif	V
A17	0,773156
A18	0,453729
A19	0,605383
A20	0,828896
A21	0,789324
A22	0,620244
A23	0,111257
A24	0,398585
A25	0,592913

3.2 Verification of TOPSIS Calculations with the TOPSIS Application Tool

Verification activities are carried out to ensure that the calculations which has been done manually in this study was appropriate. The application used was developed on a local server environment, namely http://localhost and using PHP and Mysql. The following is a display of the TOPSIS stages using the TOPSIS calculation application using research data at SDN 01 Perigi Tangerang

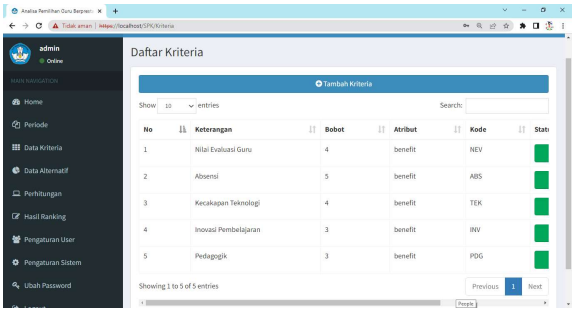

Fig1. Input Research Criteria and Criteria Weight

Figure 1 above is a display of the TOPSIS calculation application where the display menu is used to enter criteria where based on this research there are 5 Criteria, namely Evaluation Value (C1), Absence (C2), Technology Proficiency (C3), Learning Innovation (C4), and Pedagogic (C5). Then input is done sequentially on each criterion with a value (4, 5, 4, 3, 3).

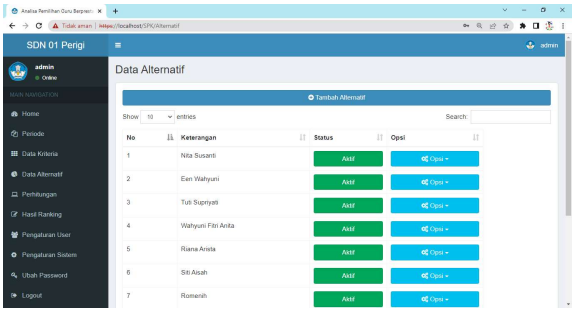

Fig 2 Alternative Data Input

Figure 2 above is a display of the TOPSIS calculation application where the menu display is used to enter alternatives along with assessments based on criteria where based on this study there are 25 alternatives.

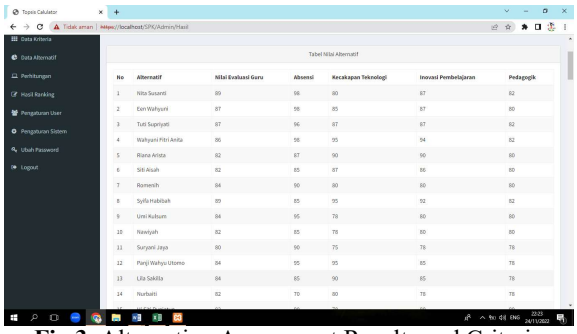

Fig 3. Alternative Assessment Results and Criteria

Figure 3 above is a display of the TOPSIS calculation application where the menu display is used to see the results of the calculation data for each alternative based on 5 criteria, meaning that each teacher is given an assessment by an assessor, namely the Principal.

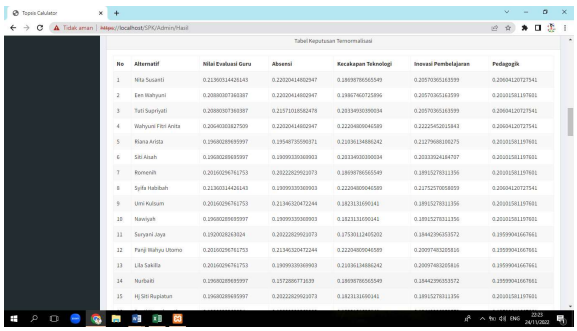

Fig 4. Normalization Matrix Assessment Results

Figure 4 above is a display of the TOPSIS calculation application where the menu display is used to calculate matrix normalization results from 25 alternatives.

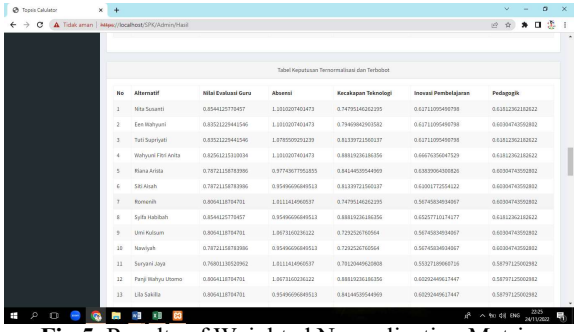

Fig 5. Results of Weighted Normalization Matrix Assessment

Figure 5 above is a display of the TOPSIS calculation application where this menu display is used to calculate weighted normalization results based on the continuation of the previous calculation.

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Fig 6. Positive Ideal Solutions A+ and Negative A-

Figure 6 above is a display of the TOPSIS calculation application where the menu display is used to see the calculation results of the Ideal Positive A+ and Negative A- solutions.

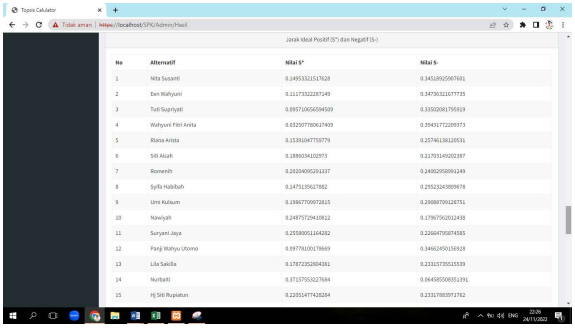

Fig 7. Display of Calculation Results of Positive and Negative Ideal Solution Distances

Figure 7 above is a display of the TOPSIS calculation application where the menu display is used to see the calculation results of the Calculation Results of Positive and Negative Ideal Solution Distances based on the values A+ and A- in the previous calculation .

No	Alternatif	Nilai RC
1	Wahyuni Fitri Anita	0.9238382406632
2	Arbaini	0.8288960859932
3	Abdul Qodir	0.7893242549345
4	Panji Wahyu Utomo	0.7799734678164
5	Tuti Supriyati	0.7777950712942
6	Rista Milla Karmella	0.7731564517488
7	Een Wahyuni	0.7566236345527
8	Nita Susanti	0.6977432339165
9	Syifa Habibah	0.6668212417653
10	Riana Arista	0.6258604610300
11	Uus Husna	0.6202435374826
12	Nur Hasanah	0.6053831188600
13	Umi Kulsum	0.5941763345177
14	Luthfiah	0.5929129131506
15	Lila Sakilla	0.5660795746197
16	Romenih	0.5429667138148
17	Siti Aisah	0.5350414640898
18	Hj Siti Rupiatun	0.5139566273846
19	Suryani Jaya	0.4697868739
20	Dedeh Maolidah	0.4537289706818
21	Nawiyah	0.4193786568575
22	Dede Robiatul	0.3955852955291
23	Santi Kemalawati	0.3976589864877
24	Nurbaiti	0.1480772062043
25	Deden Saputra	0.1112572857825

Fig 8 Preference Calculation Results

Based on Figure 8 above, it can be ascertained that the ranking order is the same as the manual results where out of 25 names the 10 highest names will be taken as outstanding teachers. The results of the ranking can be used by decision makers, namely the Principal in the form of an official circular generated by the application which can be seen in Figure 9 below,

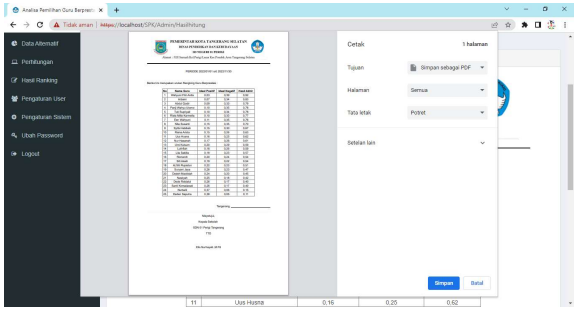

Fig 9. Results of the TOPSIS Rating Form

The comparison of the results of manual calculations and using the application can be seen in Table XI below,

Table XI .Results Comparison

Rank	Manual Calculation	Manual Score	Application Calculation	Application Score
1	Wahyuni Fitri Anita	0,923838	Wahyuni Fitri Anita	0,923838
2	Arbaini	0,828896	Arbaini	0,828896
3	Abdul Qodir	0,789324	Abdul Qodir	0,789324
4	Panji Wahyu Utomo	0,779973	Panji Wahyu Utomo	0,779973
5	Tuti Supriyati	0,777795	Tuti Supriyati	0,777795
6	Rista Milla Karmella	0,773156	Rista Milla Karmella	0,773156
7	Een Wahyuni	0,756624	Een Wahyuni	0,756624
8	Nita Susanti	0,697743	Nita Susanti	0,697743
9	Syifa Habibah	0,666821	Syifa Habibah	0,666821
10	Riana Arista	0,62586	Riana Arista	0,62586

Based on the ranking and validation results between manual calculations in Table IV.10, the results obtained are 10 teacher ratings achievement at SDN 01 Perigi Tangerang, with first to tenth place, namely Wahyuni Fitri Anita (0.923838), Arbaini (0.828896), Abdul Qodir (0.789324), Panji Wahyu Utomo (0.779973), Tuti Supriyati (0.777795) Rista Milla Karmella (0.773156), Een Wahyuni (0.756624), Nita Susanti (0.697743), Syifa Habibah (0.666821), Riana Arista (0.62586).

IV. CONCLUSION

Based on the results of the research that was carried out in this study using the TOPSIS method to determine outstanding teachers at SD Negeri 01 Perigi, the following conclusions were obtained:

1. The results of calculations using TOPSIS are able to provide a ranking order for the 10 best achieving teachers, namely Wahyuni Fitri Anita, Arbaini, Abdul Qodir, Panji Wahyu Utomo, Tuti Supriyati, Rista Milla Karmella, Een Wahyuni, Nita Susanti, Syifa Habibah, and Riana Arista.
2. Calculation results using TOPSIS can be used by SD Negeri 01 Perigi as a reference for Assessment Criteria in making decisions to determine Outstanding Teachers
3. Calculation results using TOPSIS can reduce the subjectivity of teacher assessments made by decision makers.

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Suggestions that can be given for further research are as follows:

1. Application program with the TOPSIS method can be developed that can be implemented at the research location
2. Additional criteria for other assessment criteria can be carried out in order to see differences in ranking results with the addition of additional criteria.
3. Comparative analysis can be carried out using different methods with the same research data to see if there are differences in the results and accuracy of the calculation results of other methods.

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