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IMPLEMENTATION OF ELECTRE ALGORITHM IN DECISION SUPPORT SYSTEM FOR SELECTING EXEMPLARY STUDENT

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Abstract— One of the activities undertaken by the school to reward students for increasing motivation and enthusiasm for learning is the process of selecting exemplary students. Based on the observation of one of the junior high schools in Pekanbaru, the problem of difficulty in selecting the model students was obtained. This is because there are so many aspects and components of assessment that must be considered and taken into account by the school, both in terms of academic and non-academic students. Decision support system (SPK) plays an important role in supporting a decision, this research makes a model design in the form of a decision support system by applying the ELECTRE (Elimination Et Choix Traduisant La Relite) algorithm. The ELECTRE method is one of the Multi-Attribute Decision Making (MADM) methods that can provide decision recommendations based on the complexity of the attributes or criteria used in a decision support system. In this study, there are 8 components of the criteria used in the process of selecting exemplary students, namely the average report card, ranking, absenteeism, morals, achievements, organization, attitudes, and points of the violation. Based on the test results of the model built, it was found that the ELECTRE algorithm was able to select and rank 6 alternative model students based on assessment components and predetermined criteria. With the results of student A obtaining the highest aggregate value (2), followed by students B, C, D, E, and F with aggregate value 1 and finally student G with aggregate value 0. So student A can be proposed as a model student.

Keywords: Decision Support System (DSS), ELECTRE Algorithm, Exemplary Student.

Abstrak—*Salah satu kegiatan yang dilakukan sekolah dalam upaya memberikan penghargaan kepada peserta didik untuk meningkatkan motivasi dan semangat belajar adalah proses pemilihan siswa teladan. Berdasarkan obervasi terhadap salah satu sekolah menengah pertama di Kota Pekanbaru, diperoleh permasalahan sulitnya dalam melakukan proses pemilihan siswa teladan tersebut. Hal ini dikarenakan sangat banyak aspek dan komponen penilaian yang harus dipertimbangkan dan diperhitungkan pihak sekolah, baik dari sisi akademik maupun non akademik peserta didik. Sistem pendukung keputusan (SPK) memegang peran penting dalam mendukung sebuah keputusan, penelitian ini membuat perancangan model dalam bentuk sistem pendukung keputusan dengan menerapkan algoritma ELECTRE (Elemination Et Choix Traduisant La Relite). Metode ELECTRE merupakan salah satu metode Multi Attribute Decision Making (MADM) yang mampu memberikan hasil rekomendasi keputusan berdasarkan kompleks nya atribut atau kriteria yang digunakan dalam sebuah sistem pendukung pengambilan keputusan. Pada penelitian ini, terdapat 8 komponen kriteria yang digunakan dalam proses pemilihan siswa teladan yaitu rata-rata nilai rapor, rangking, absensi, akhlak, prestasi, keorganisasian, sikap, dan poin pelanggaran. Berdasarkan hasil pengujian dari model yang dibangun, diperoleh hasil bahwa algoritma ELECTRE mampu melakukan pemilihan serta perangkingan terhadap 6 alternatif siswa teladan berdasarkan komponen penilaian dan kriteria yang telah ditetapkan. Dengan hasil siswa A memperoleh nilai aggregate tertinggi (2), diikuti oleh siswa B, C, D, E dan F dengan nilai aggregate 1 dan terakhir siswa G dengan nilai aggregate 0. Sehingga siswa A dapat diusulkan sebagai siswa teladan.*

Kata Kunci*: Algoritma ELECTRE, MADM, Sistem Pendukung Keputusan (SPK), Siswa Teladan.*

INTRODUCTION

To support achieving the goals of national education, schools as education institutions develop various coaching systems that motivate and develop the potential of students, one of which is by providing rewards the exemplary student predicate for students [1]. The predicate as an exemplary student is generally reserved for students who have very prominent academic achievements, and become students who are very obedient to school rules [2]. But in reality, if the process of selecting and determining who will be an exemplary student in a school only considers academic achievement, then "The Exemplary Student" is only a venue for a prestigious title that can be won by students who have prominent academic values. Then, what about other students who may be on the academic side of mediocrity but have prominent non-academic abilities? Many other factors must be considered by the school in the process of selecting these exemplary students so that the predicate is truly on target, fair and the goal of national education can be achieved [3], [4], [5], [6], [7]. Based on the observation of one of the junior high schools in Pekanbaru, this study tried to help the school in the process of selecting exemplary students using the Decision Support System (DSS).

Decision Support Systems (DSS) are part of computer-based information systems including knowledge-based systems (knowledge management) that are used to support decision making in a corporate organization or educational institution [4][8]. Previous related research that has used DSS in selecting the best students, high achieving students, and model students using Multi-Attribute Decision Making (MADM) on DSS such as the Technique for Other Preference by Similarity to Ideal Solution (TOPSIS) method [3], [4]. Analytical Hierarchy Process (AHP) method [1], [2], [9]. Simple Additive Weight (SAW) method [6], [7]. Weighted Product (WP) method [5], [10]. While for the Elimination Et Choix Traduisant La Relite (ELECTRE) method, previous studies raised non-educational problems [11]–[14]. Thus, in this study, the author will raise the topic of Implementation of ELECTRE in the Decision Support System for Selecting Exemplary Student. This research will enrich previous studies in the world of Education by utilizing technological advances in the implementation of the ELECTRE algorithm in Decision Support Systems. This study aims to determine the criteria and ideal weight for selection the exemplary students in one of the junior high schools in Pekanbaru, testing the ELECTRE Algorithm in ranking process for selection of exemplary students, and developing the DSS model with the ELECTRE Algorithm approach.

RESEARCH METHODOLOGY

The stages of research into the implementation of the ELECTRE algorithm to the decision support system for the determination the exemplary student can be seen in the following Figure 1.

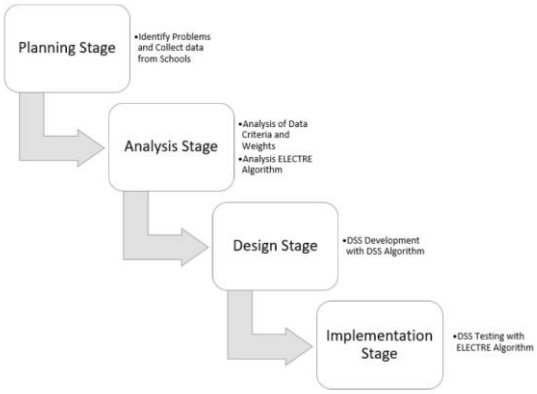

Figure 1 Research Stages

The stages of planning this study began by identifying the problem of the process of selecting exemplary students and collecting data from schools that were observed. The data collection process is carried out directly by conducting observations and interviews with school principals, and vice school principals in the academic and student fields. Furthermore, the stages of analysis are carried out by focusing on analyzing all aspects of the data and information obtained from the results of the exemplary student selection instruments with scores set by the school, studying the characters or criteria to be assessed, so that an assessment of the predetermined criteria can be assessed. Then also performed an analysis of the ELECTRE algorithm for compatibility between the data obtained with the stages of the algorithm. Followed by the design phase of the decision support system interface will be built web-based by implementing the stages of the ELECTRE algorithm calculation process. The final stage is the implementation and testing of decision support systems for the selection of exemplary students using the ELECTRE algorithm, by providing input data according to established criteria and weights, then calculated according to the ELECTRE algorithm and resulting in the ranking of students who most recommended as an exemplary students.

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DISCUSSION AND RESULTS

In this study, the criterion component used is the average value of report cards, rank in class, attendance, morals, achievements, organizational, attitudes, and point of the violation. Preference weights are the weight of the importance of each criterion and have a Max function because the largest value is the best value. More details can be seen in Table 1. The Criteria Data as follows:

Table 1. The Criteria Data

Codes	Criteria Names	Preference Weights	Function
C1	The Average Value of Report Cards	3	MAX
C2	Rank in Class	2	MAX
C3	Number of Absences	4	MAX
C4	Morals	5	MAX
C5	Achievements	3	MAX
C6	Organizational	4	MAX
C7	Attitudes	3	MAX
C8	Point of the Violation	4	MAX

Then analyze the criteria for the selection of exemplary students, resulting in Table 2. Rank the Weight Value of Criteria as follows:

Table 2. Rank the Weight Value of Criteria

The rank of the Weight Value	Information
5	Very Good
4	Good
3	Pretty Good
2	Not Good
1	Very Not Good

Next, the weight value is given for each sub-criteria of each criterion, resulting in Table 3. Grading the Weight of Each Sub-Criteria as follows:

Table 3. Grading the Weight Value of Each Sub-Criteria

Criteria Code	Sub-Criteria	Weight Value
C1 The Average Value of Report Cards	90-100	5
	80-89	4
	70-79	3
	50-69	2
	0-49	1
C2 Rank in Class	1	5
	2	4
	3	3
	4	2
	>5	1
C3 Number of Absences	0	5
	1	4
	2	3
	4, 5	2
	>6	1
C4 Morals	90-100	5
	80-89	4
	70-79	3
	50-69	2
	0-49	1
C5 Achievements	International	5
	National	4
	Province	3
	City	2
	Does Not Participate	1
C6 Organizational	Head	5
	Secretary	4
	Treasurer	3
	Ordinary Member	2
	Does Not Participate	1
C7 Attitudes	A	5
	B	4
	C	3
	D	2
	E	1
C8 Point of Violation	0	5
	1-10	4
	11-20	3
	21-30	2
	>31	1

The next stage is to carry out the calculation process using the ELECTRE method. Suppose 6 prospective students will participate in the selection of exemplary students, namely students A, B, C, D, E, and F. Using Table 1. The Criteria Data obtained the value for W={3,2,4,5,3,4,3,4} resulting in Table 4. Ratings of Match from Each Alternative Against the Criteria as follows:

Tabla 4. Ratings of Match from Each Alternative Against the Criteria

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A	5	5	5	4	3	1	5	5
B	4	1	2	4	2	1	5	5
C	4	3	5	4	2	2	5	4
D	4	1	4	4	1	1	5	4
E	4	2	5	4	3	2	5	5
F	4	1	1	4	2	1	4	3

Based on table 4. above, can be formed a decision matrix as follows:

$$X = \begin{bmatrix} 5 & 5 & 5 & 4 & 3 & 1 & 5 & 5 \\ 4 & 1 & 2 & 4 & 2 & 1 & 5 & 5 \\ 4 & 3 & 5 & 4 & 2 & 2 & 5 & 4 \\ 4 & 1 & 4 & 4 & 1 & 1 & 5 & 4 \\ 4 & 2 & 5 & 4 & 3 & 2 & 5 & 5 \\ 4 & 1 & 1 & 4 & 2 & 1 & 4 & 3 \end{bmatrix}$$

Stages compare in pairs for each alternative in each criterion, resulting in Table 5. Normalization Matrix Data.

Table 5. Normalization Matrix Data

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A	0,4879	0,7808	0,5103	0,4082	0,5388	0,2886	0, 4210	0,4642
B	0,3903	0,1561	0,2041	0,4082	0,3592	0,2886	0, 4210	0,4642
C	0,3903	0,4685	0,5103	0,4082	0,3592	0,5773	0, 4210	0,3713
D	0,3903	0,1562	0,3061	0,4082	0,1796	0,2886	0, 4210	0,3713
E	0,3903	0,3123	0,5103	0,4082	0,5388	0,5773	0, 4210	0,4642
F	0,3903	0,1561	0,1020	0,4082	0,3592	0,2886	0, 3368	0,2785

The stages of calculating the importance factor (weight value) in each criterion are done by multiplying the preference weight (W_j) with a normalized matrix. Resulting in Table 6. Weighting Matrix Data.

Table 6. Weighting Matrix Data

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A	1,4637	1,5616	2,0412	2,041	1,6164	1,1544	1,2246	1,9612
B	1,1709	0,3122	0,8164	2,041	1,0776	1,1544	1,2246	1,9612
C	1,1709	0.937	2,0412	2,041	1,0776	2,3092	1,2246	1,5048
D	1,1709	0,3122	1,2244	2,041	0,5388	1,1544	1,2246	1,5048
E	1,1709	0,6246	2,0412	2,041	1,6164	2,3092	1,2246	1,8812
F	1,1709	0,3122	0,408	2,041	1,0776	1,1544	1,2246	1,1288

After getting the weighting importance factor in Table 6, then next determine the Concordance and Discordance of each alternative. So that it can look like in Table 7. The Concordance Matrix Data, and Table 8. Discordance Matrix Data, as follows:

Table 7. The Concordance Matrix Data

Alt.	C1	C2	C3	C4	C5	C6
A		1,2,3,4,5, 6,7,8	1,2,3,4, 5,7,8	1,2,3,4,5, 6,7,8	1,2,3,4,5,7,8	1,2,3,4,5,6,7,8
B	4,6,7,z		1,4,5,7,8	1,2,4,5,6, 7,8	1,4,7,8	1,2,3,4,5, 6,7,8
C	3,4,6	1,2,3,4,5,6		1,2,3,4,5,6,7,8	1,2,3,4,6,7	1,2,3,4,5, 6,7,8
D	4,6	1,2,3,4,6	1,4,7,8		1,4,7	1,2,3,4,6,7,8
E	3,4,5,6,8	1,2,3,4,5,6,8	1,3,4,5,6,8	1,2,3,4,5,6,7,8		1,2,3,4,5 ,6,7,8
F	4,6,	1,2,4,5,6	1,4,5	1,2,4,5,6	1,4	

Table 8. Discordance Matrix Data

Alternative	D1	D2	D3	D4	D5	D6
A		0	1	0	1	0
B	1		1	1	1	0
C	0,5410	0,3032		0	1	0
D	1	0,6599	1		1	0,4399
E	0,8115	0	0, 5796	0		0
F	1	1	1	1	1	

To calculate the Concordance matrix, the value of the threshold (C) is to determine the value of the elements in the concordance matrix by adding up the weights included in the concordance set.

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C = 20,9

Calculating the Discordance matrix, the threshold value (D) is to determine the value of the elements in the discordance matrix with add up the weights that are included in the discordance set.

D = 0,4776

Concordance dominant matrix can be built with the help of a threshold value, namely by comparing each element value of the concordance matrix with the threshold value C. To produce Table 9. Concordance Dominant Matrix Data, as follows:

Table 9. Concordance Dominant Matrix Data

Alternative	C1	C2	C3	C4	C5	C6
A		1	1	1	1	1
B	0		0	1	0	1
C	0	1		1	1	1
D	0	1	0		0	1
E	1	1	1	1		1
F	0	0	0	0	0	

Discordance dominant matrix can be built with the help of a threshold value, namely by comparing each element value of the concordance matrix with the threshold value D. To produce Table 10. Discordance Dominant Matrix Data, as follows:

Table 10. Discordance Dominant Matrix Data

Alternative	D1	D2	D3	D4	D5	D6
A		0	1	0	1	0
B	1		1	1	1	0
C	0	0		0	1	0
D	1	1	1		1	0
E	1	0	0	0		0
F	1	1	1	1	1	

The next step is to determine the aggregate dominance matrix as the E matrix, each of these elements is a multiplication between the matrix F element and the G matrix. This results in Table 11. Aggregate Dominance Matrix Data, as follows:

Table 11. Aggregate Dominance Matrix Data

Alternative	E1	E2	E3	E4	E5	E6	Final Result
A		0	1	0	1	0	**2**
B	0		1	0	0	0	1
C	0	0		0	1	0	1
D	0	1	0		0	0	1
E	1	0	0	0		0	1
F	0	0	0	0	0		0

The ranking results obtained that A1 is an alternative for the exemplary student from 6 other alternatives. From the results of the aggregate matrix, it can be concluded that A1 dominates with the value of 1 most. In other words, student A is the best alternative to the process of selecting exemplary students using the ELECTRE method.

For the stages of system development and testing the calculation process, it can be seen starting in Figure 2. Input Criteria Data, as follows :

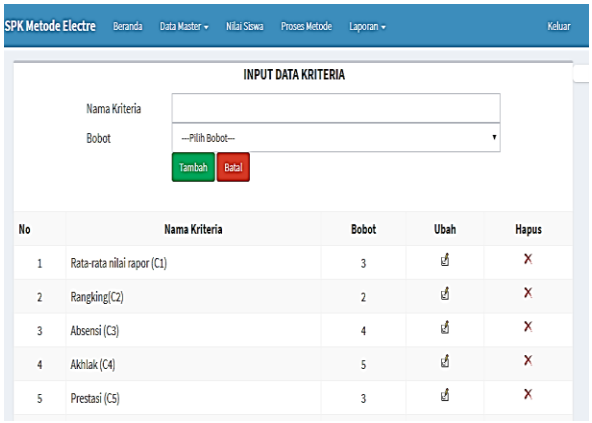


Figure 2. Input Criteria Data

Furthermore, to fill in the sub-criteria data used, it can be seen in Figure 3. Input Data Sub-criteria, as follows:

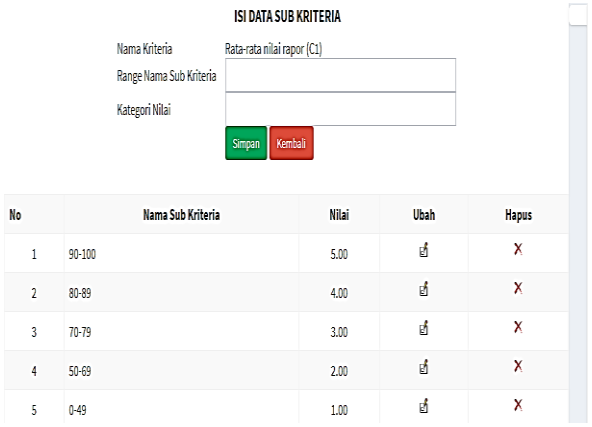
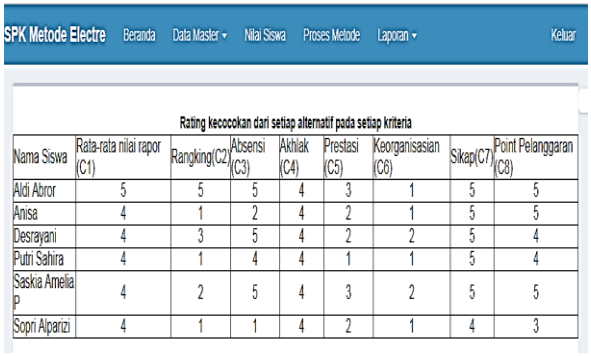


Figure 3. Input Sub-Criteria Data

The calculation of the compatibility rating of each alternative on each criterion can be seen in Figure 4. The Match Rating of Each Alternative on Each Criterion, as follows:


SPK Metode Electre Beranda Data Master Nilai Siswa Proses Metode Laporan Keluar

Rating kecocokan dari setiap alternatif pada setiap kriteria

Nama Siswa	Rata-rata nilai rapor (C1)	Rangking(C2)	Absensi (C3)	Akhlak (C4)	Prestasi (C5)	Keorganisasian (C6)	Sikap(C7)	Point Pelanggaran (C8)
Aldi Abror	5	5	5	4	3	1	5	5
Anisa	4	1	2	4	2	1	5	5
Desrayani	4	3	5	4	2	2	5	4
Putri Sahira	4	1	4	4	1	1	5	4
Saskia Amelia P	4	2	5	4	3	2	5	5
Sopri Alparizi	4	1	1	4	2	1	4	3

Figure 4. The Match Rating of Each Alternative on Each Criterion

The process of comparing in pairs for each alternative in each criterion can be seen in Table 12. The Process of Comparing in Pairs for Each Alternative in Each Criterion, as follows:

Table 12. The Process of Comparing in Pairs for Each Alternative in Each Criterion

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A1	0,4879	0,7808	0,5103	0,4082	0,5388	0,2886	0, 4210	0,4642
A2	0,3903	0,1561	0,2041	0,4082	0,3592	0,2886	0, 4210	0,4642
A3	0,3903	0,4685	0,5103	0,4082	0,3592	0,5773	0, 4210	0,3713
A4	0,3903	0,1562	0,3061	0,4082	0,1796	0,2886	0, 4210	0,3713
A5	0,3903	0,3123	0,5103	0,4082	0,5388	0,5773	0, 4210	0,4642
A6	0,3903	0,1561	0,1020	0,4082	0,3592	0,2886	0, 3368	0,2785

The process of calculating the factors of interest in each criterion can be seen in Table 13. The Process of Calculating the Factors of Interest in Each Criterion, as follows:
Weight (w) = {3,2,4,5,3,4,3,4}

Table 13. The Process of Calculating the Factors of Interest in Each Criterion

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A1	1,4637	1,5616	2,0412	2,041	1,6164	1,1544	1,2246	1,9612
A2	1,1709	0,3122	0,8164	2,041	1,0776	1,1544	1,2246	1,9612
A3	1,1709	0.937	2,0412	2,041	1,0776	2,3092	1,2246	1,5048
A4	1,1709	0,3122	1,2244	2,041	0,5388	1,1544	1,2246	1,5048
A5	1,1709	0,6246	2,0412	2,041	1,6164	2,3092	1,2246	1,8812
A6	1,1709	0,3122	0,408	2,041	1,0776	1,1544	1,2246	1,1288

The results of ranking using the ELECTRE method for the selection of exemplary students can be seen in Figure 5. Results of ELECTRE Calculation and Ranking of Exemplary Student Elections, as follows:


Hasil Perangkingan Metode Electre

Ranking	Alternatif	Nilai
1	Aldi Abror	2
2	Anisa	1
3	Desrayani	1
4	Putri Sahira	1
5	Saskia Amelia P	1
6	Sopri Alparizi	0

Siswa Teladan Hasil Metode Electre adalah Aldi Abror dengan Jumlah Nilai 1 Terbanyak = 2

Figure 5. Results of ELECTRE Calculation and Ranking of Exemplary Student Elections

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Of the six alternative prospective students, after calculating the ELECTRE method the ranking results are obtained: Aldi Abror has the highest aggregate value of 2, followed by Anisa, Desrayani, Putri Sahira, Saskia Amelia P who have aggregate 1, and in the last Sopri Alparizi with an aggregate value of 0.

CONCLUSION

Based on the results of the analysis of calculations and the construction of decision support systems for the selection of exemplary students by applying the ELECTRE method, it can be concluded that the ELECTRE method can be applied in the decision support system model (DSS) for the case of the selection of exemplary students by using several criteria, namely the average value of report cards, rank in class, absenteeism, morals, achievement, organizational, attitudes and points of a violation. From the results of the trial of 6 proposed student data and 8 criteria used, the ELECTRE method can select the data rank of students from the highest to the lowest results.

REFERENCES

[1] D. Setiyawan, "Sistem Pendukung Keputusan Penentuan Siswa Teladang Di SMA Negeri 7 Semarang Menggunakan Metode Fuzzy AHP," Universitas Dian Nuswantoro Semarang, 2014.

[2] S. Pojoh, O. A. Lantang, and P. D. K. Manembu, "Sistem Pendukung Keputusan untuk Menentukan Siswa Berprestasi yang Layak Menjadi Siswa Teladan," *J. Tek. Inform.*, vol. 8, no. 1, 2016, doi: 10.35793/jti.8.1.2016.12823.

[3] K. C. Pradewa, "Sistem Pendukung Keputusan Pemberian Predikat Siswa Teladang Dengan Metode TOPSIS Berbasis Web," Universitas Nusantara PGRI Kediri, 2016.

[4] R. Adawiyah, "Sistem Pendukung Keputusan Penentuan Siswa Teladan Dengan Menggunakan Metode TOPSIS," in *Seminar Nasional Informatika*, 2015, pp. 603–607.

[5] D. Prabawati, "Pembangunan Sistem Pemilihan Siswa Berprestasi Menggunakan Multiattribute Decision Making Dengan Metode Penyelesaian Weighted Product (Studi Kasus : LPIA Surapati Core Bandung)," Universitas Pendidikan Indonesia, 2012.

[6] E. Fitriatun, "Prototipe Sistem Pendukung Keputusan Pemilihan Siswa Siswi Teladan Di Tingkat Sekolah Menengah Atas dengan metode SAW (Simple Additive Weighting)," Universitas Muhammadiyah Ponorogo, 2016.

[7] E. Kurniadi, "Sistem Informasi Penentuan Siswa Berprestasi Dengan Metode Simple Additive Weighting (SAW)," *J. Inf. Syst.*, vol. 1, no. 2, pp. 1–7, 2016, doi: 10.1017/CBO9781107415324.004.

[8] A. J. Ternando, R. Efendi, and E. P. Purwandari, "Sistem Pendukung Keputusan Dalam Pemilihan Penginapan di Kota Bengkulu Menggunakan Metode Simple Additive Weighting (SAW)," *J. Rekursif*, vol. 6, no. 1, pp. 24–35, 2018, [Online]. Available: https://ejournal.unib.ac.id/index.php/rekursif/article/view/4360.

[9] B. Sinaga and H. M. Zebua, "Sistem Pendukung Keputusan Siswa Berprestasi Menggunakan Metode Analytic Hiearchy Process (AHP) Pada SMK Singosari Delitua," *J. Mantik Penusa*, vol. 16, no. 2, pp. 1–11, 2014, doi: 10.1183/09031936.00190208.

[10] S. Budiono, "Sistem Pendukung Keputusan Pemilihan Siswa Terbaik Menggunakan Metode WP (Studi Kasus di SMP Ma'arif NU Benjeng)," Universitas Muhammadiyah Gresik, 2019.

[11] Supriatin, "Penerapan algoritma electre dalam menentukan lokasi shetler trans jogja," *TEKNOMATIKA*, vol. 9, no. 2, pp. 39–47, 2017, [Online]. Available: http://teknomatika.stmikayani.ac.id/wp-content/uploads/2017/07/4.-PENERAPAN-ALGORITMA-ELECTRE-DALAM-MENENTUKAN-LOKASI-SHETLER-TRANS-JOGJA-SUPRIATIN.pdf.

[12] A. P. Windarto and W. P. Mustika, "Penerapan Algoritma ELECTRE pada Pemilihan Cream Pelembab Berdasarkan Konsumen," *J. Media Inform. Budidarma*, vol. 4, no. 1, p. 229, 2020, doi: 10.30865/mib.v4i1.1966.

[13] Y. B. C. B. Irawan, "Sistem Pendukung

Pengambilan Keputusan Pemilihan Faskes BPJS Tingkat I Menggunakan Metide ELECTRE," Universitas Sanata Dharma, 2017.

[14] F. Setiawan, F. Indriani, and Muliadi, "Implementasi Metode Electre Pada Sistem Pendukung Keputusan SNMPTN Jalur Undangan," *Kumpul. J. Ilmu Komput.*, vol. 02, no. 02, pp. 88–101, 2015, [Online]. Available: http://klik.ulm.ac.id/index.php/klik/article/download/29/27.

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