

Application of SAW Method in Decision Support System for Determination of Exemplary Students

Fadila Shely Amalia^{1*}, Debby Alita²

^{1*}Computer Science, Universitas Gajah Mada, Indonesia

²Informatika, Universitas Teknokrat Indonesia, Indonesia

^{1*}fadilashelyamalia@mail.ugm.ac.id, ²debbyalita@teknokrat.ac.id

Abstract: The decision support system for determining exemplary students using the SAW method is a solution to existing problems so that the results of the assessment of exemplary students become more effective and efficient in terms of time and selection of exemplary students. Decision-making in the determination of exemplary students can be more detailed and more accurate from existing candidates to truly exemplary prospective students who meet the established criteria. This SAW method can help teachers in making decisions using weights that have been determined by the school. The results of the decision support system for determining exemplary students using the SAW method for Rank 1 were obtained by M. Pebi Ramadhan with a value of 0.992857. Rank 2 was obtained by Adittyo Yunanta with a value of 0.984286. Rank 3 was obtained by Aldo Al Farigi with a value of 0.982857.

Keywords: Assessment; Criteria; Decision Support System; SAW; Student.

1. INTRODUCING

Technology is referred to as something that is able to provide convenience in various aspects. In terms of education, technology also exerts its considerable influence. These two things are increasingly inseparable because the roles of the two are interconnected with each other. Education is one aspect that is believed to open up opportunities to improve the quality of life. However, education that does not run optimally will also not have a good impact either. Well, the existence of technology can be one way to improve the quality of education[1]. Especially the quality of domestic education. There are many benefits that can be obtained if technology is used properly and will certainly further improve the quality of education of the Indonesian people.

Encouraging students to compete to become exemplary students is a good program for schools to organize. With this activity, it is hoped that other students can follow the example and be motivated to do good things according to the specified criteria of exemplary students. Being an exemplary student includes great achievements in academic careers. Being a model student can provide tangible benefits as the opportunity to get admitted to a good college, the possibility to get a scholarship or financial assistance from a specific agency/sponsor, or the opportunity to get a job offer that you have been dreaming of. However, to achieve the status of an exemplary student is not easy, therefore you must strive with earnest determination.

Fadila Shely Amalia : *corresponding author



Copyright © 2023, Fadila Shelly Amalia, Debby Alita.

Decision Support System (DSS) is a system that is able to provide problem-solving capabilities and communication skills for problems with semi-structured and unstructured conditions. This system is used to assist decision-making in semi-structured and unstructured situations, where no one knows exactly how decisions should be made. DSS aims to provide information, guide, provide predictions and direct information users to make better decisions. DSS can help solve semi-structured problems, support managers in making decisions on a problem, and improve effectiveness instead of decision-making efficiency[2], [3].

Fuzzy Multiple Attribute Decision Making (FMADM) is a method used to find optimal alternatives from a number of alternatives with certain criteria. The essence of FMADM is to determine the weight value for each attribute, then proceed with the ranking process that will select the alternatives that have been given. Basically, there are 3 approaches to look for attribute weight values, namely the subjective approach, the objective approach and the integration approach between the subjective and the objective[4]. Each of the approaches has its advantages and disadvantages. In the subjective approach, the value of weights is determined based on the subjectivity of the decision makers, so that several factors in the alternative ranking process can be determined freely[5], [6]. Whereas in the objective approach, the weight value is calculated mathematically so as to ignore the subjectivity of the decision maker. The Simple Additive Weighting (SAW) algorithm is one of the algorithms used for decision making. The SAW algorithm is also known as the algorithm with a weighted summation method. This method requires normalizing the decision matrix to a scale that can be compared to all existing alternative ratings[4], [7], [8].

Research related to the application of the SAW method that has been carried out includes determining outstanding students at Mustafa Private Vocational School with a more efficient and effective system. This system is designed using a decision support system through the Simple Additive Weighting (SAW) method. This system can display the results of ranking outstanding students based on the calculation results of the SAW method[9]. DSS can be used to process outsourced employee information from the outsourced employee data entry process, the outsourced employee evaluation entry process, and the outsourcing employee calculation process. By using the SAW method so that it can determine the ranking and evaluation process, it can do well in accordance with existing values, weights, and criteria, and the results obtained will be more objective and precise[8]. The purpose of this research is expected to help neotech stores in determining the best suppliers using this DSS, in this DSS has also been provided ranking reports, selection reports and supplier assessment reports. SAW is used to find the priority value of ranking for each alternative followed by cost and benefit[10].

2. METHOD

Research Stages

The research stage is a scientific way that is used to obtain data that is in accordance with the purpose of the study[11], [12]. The stages of the study can be seen in figure 1.

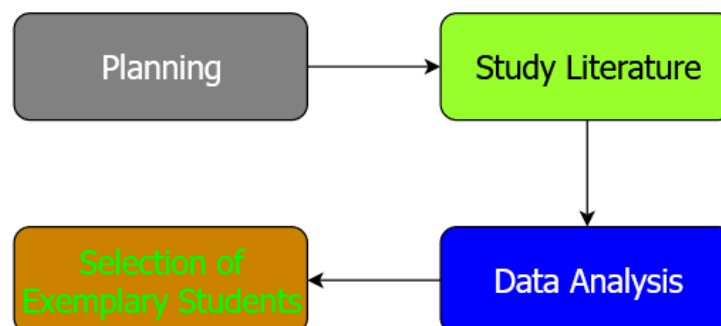


Figure 1. Stages of Research

1. This stage the author conducts interviews with teachers related to the data on the determination of exemplary students who will be used by the author as an alternative in the selection of exemplary students in the school.
2. This stage the author traces pre-existing articles and studies them and reads several books related to the determination of exemplary students and the SAW method.
3. This stage the author selected a sample of data, there were twelve student data samples used by the author in conducting this study and four criteria in determining exemplary students carried out at the end of each semester held by the school. In addition, it also conducts testing using the SAW (simple additive weighting) method against alternatives and criteria used. After that, the author conducted a review of the student alternatives used as samples so that the final results could get exemplary students ranked one, ranked second and ranked third from the selection of exemplary students carried out at the end of each semester.
4. This stage determines the results and resumes of three students who will be exemplary students in the school.

Simple Additive Weighting Method

The SAW method or also known as the weighted summation method is one of the methods in decision support systems to find weighted summation of the performance rating on each alternative on all attributes. The SAW method can help in making decisions on a case that occurs, but in this SAW method those who are selected as the best alternative are only those that have or that produce the greatest value. The SAW method is also the most widely used method in dealing with Multiple Atribust Decision Making (MADM) situations where MADM is a method used to find optimal alternatives from a number of alternatives with certain criteria[13]–[15].

3. RESULT AND DISCUSSIONS

One of the problems faced in determining exemplary students is because there is no decision model to determine exemplary students so that the selection is based on the assessment of teachers based on the assessment of students, for that the determination of the criteria and weights of each student must meet the specified requirements so that the best results can be obtained. The following are criteria for determining exemplary students

Table 1. Criteria and Weight Data

Criteria Code	Criteria Name	Types of Criteria	Weight Criteria
C1	Report Card Value	Benefit	35
C2	Presence	Benefit	25
C3	Personality	Benefit	25
C4	Extracurricular	Benefit	15

After determining the criteria and weights further determine the value for the personality and extracurricular criteria due to the form of assessment based on linguistic data.

Table 2. Criteria Value

Description	Value
Excellent	4
Good	3
Enough	2
Less	1

The next process is to get an assessment from the teacher to determine the exemplary students in the school. The following is exemplary prospective student data based on the observational data obtained.

Table 3. Exemplary Student Prospective Assessment Data

Student	Report Card Value	Presence	Personality	Extracurricular
Anggraini Putri Liana	98	95	4	3
Boni Sandria	94	98	3	3
Hendi Kurniawan	95	97	3	4
M. Pebi Ramadhan	96	100	4	4
Nopebrian Saputra	97	98	3	3
Ida Firdaus	94	96	4	4
Rindu Apriliana Pertiwi	95	97	4	3
Aldo Al Farigi	96	96	4	4
Diki Rosandy	94	99	3	3
Sila Rianto Wijaya	96	97	3	3
Adittyo Yunanta	95	98	4	4
Ardian Yusuf	97	96	3	4

After getting the assessment results from each exemplary student, then create a decision support system using the SAW method.

1. Creating a Decision Matrix

Decision matrix, obtained from alternative values in table 2 that have been weighted by each criterion value in table 3 so that it becomes a chrips value.

$$X_{ij} = \begin{pmatrix} 98 & 95 & 4 & 3 \\ 94 & 98 & 3 & 3 \\ 95 & 97 & 3 & 4 \\ 96 & 100 & 4 & 4 \\ 97 & 98 & 3 & 3 \\ 94 & 96 & 4 & 4 \\ 95 & 97 & 4 & 3 \\ 96 & 96 & 4 & 4 \\ 94 & 99 & 3 & 3 \\ 96 & 97 & 3 & 3 \\ 95 & 98 & 4 & 4 \\ 97 & 96 & 3 & 4 \end{pmatrix}$$

MAX Value 98 100 4 4

2. Calculating the Nomalization Matrix

Furthermore, calculate the criteria value of each prospective student with the following formula.

$$R_{IJ} = \frac{x_{IJ}}{\text{Max}x_{ij}} \quad (1)$$

Information

r_{ij} = Localized performance rating value

X_{ij} = The attribute value that belongs to each criterion

Max x_{ij} = Largest value of each criterion

The results of calculating the C1 criteria value for the report card value can be seen below

$$R_{1,1} = 98/98 = 1$$

$$R_{2,1} = 94/98 = 0,959183673$$

$$\begin{aligned}
 R_{3,1} &= 95/98 = 0,969387755 \\
 R_{4,1} &= 96/98 = 0,979591837 \\
 R_{5,1} &= 97/98 = 0,989795918 \\
 R_{6,1} &= 94/98 = 0,959183673 \\
 R_{7,1} &= 95/98 = 0,969387755 \\
 R_{8,1} &= 96/98 = 0,979591837 \\
 R_{9,1} &= 94/98 = 0,959183673 \\
 R_{10,1} &= 96/98 = 0,979591837 \\
 R_{11,1} &= 95/98 = 0,969387755 \\
 R_{12,1} &= 97/98 = 0,989795918
 \end{aligned}$$

The results of calculating the C2 criteria value for the presence can be seen below

$$\begin{aligned}
 R_{1,2} &= 95/100 = 0,95 \\
 R_{2,2} &= 98/100 = 0,95 \\
 R_{3,2} &= 97/100 = 0,98 \\
 R_{4,2} &= 100/100 = 0,97 \\
 R_{5,2} &= 98/100 = 1 \\
 R_{6,2} &= 96/100 = 0,98 \\
 R_{7,2} &= 97/100 = 0,96 \\
 R_{8,2} &= 96/100 = 0,97 \\
 R_{9,2} &= 99/100 = 0,96 \\
 R_{10,2} &= 97/100 = 0,99 \\
 R_{11,2} &= 98/100 = 0,97 \\
 R_{12,2} &= 96/100 = 0,98
 \end{aligned}$$

The results of calculating the C3 criteria value for the personality can be seen below

$$\begin{aligned}
 R_{1,3} &= 4/4 = 1 \\
 R_{2,3} &= 3/4 = 0,75 \\
 R_{3,3} &= 3/4 = 0,75 \\
 R_{4,3} &= 4/4 = 1 \\
 R_{5,3} &= 3/4 = 0,75 \\
 R_{6,3} &= 4/4 = 1 \\
 R_{7,3} &= 4/4 = 1 \\
 R_{8,3} &= 4/4 = 1 \\
 R_{9,3} &= 3/4 = 0,75 \\
 R_{10,3} &= 3/4 = 0,75 \\
 R_{11,3} &= 4/4 = 1 \\
 R_{12,3} &= 3/4 = 0,75
 \end{aligned}$$

The results of calculating the C4 criteria value for the extracurricular can be seen below

$$\begin{aligned}
 R_{1,4} &= 3/4 = 0,75 \\
 R_{2,4} &= 3/4 = 0,75 \\
 R_{3,4} &= 4/4 = 1 \\
 R_{4,4} &= 4/4 = 1 \\
 R_{5,4} &= 3/4 = 0,75 \\
 R_{6,4} &= 4/4 = 1 \\
 R_{7,4} &= 3/4 = 0,75 \\
 R_{8,4} &= 4/4 = 1 \\
 R_{9,4} &= 3/4 = 0,75 \\
 R_{10,4} &= 3/4 = 0,75 \\
 R_{11,4} &= 4/4 = 1 \\
 R_{12,4} &= 4/4 = 1
 \end{aligned}$$

Based on the results of the matrix normalization process, the results of the matrix normalization are obtained as below.

$$R_{ij} = \begin{pmatrix} 1 & 0,95 & 1 & 0,75 \\ 0,959183673 & 0,95 & 0,75 & 0,75 \\ 0,969387755 & 0,98 & 0,75 & 1 \\ 0,979591837 & 0,97 & 1 & 1 \\ 0,989795918 & 1 & 0,75 & 0,75 \\ 0,959183673 & 0,98 & 1 & 1 \\ 0,969387755 & 0,96 & 1 & 0,75 \\ 0,979591837 & 0,97 & 1 & 1 \\ 0,959183673 & 0,96 & 0,75 & 0,75 \\ 0,979591837 & 0,99 & 0,75 & 0,75 \\ 0,969387755 & 0,97 & 1 & 1 \\ 0,989795918 & 0,98 & 0,75 & 1 \end{pmatrix}$$

3. Calculating Preference Values

The next stage is to calculate the preference with the following formula.

$$V_i = \sum_{j=1}^n W_j r_{ij} \quad (2)$$

Information

V_i = ranking of each alternative

W_j = weight value of each criterion

R_{ij} = Normalized Performance Rating Value

$$\begin{aligned} V_1 &= (1*0,35)+(0,95*0,25)+(1*0,25)+(0,75*0,15)= & 0,95 \\ V_2 &= (0,959183673*0,35)+(0,95*0,25)+(0,75*0,25)+(0,75*0,15)= & 0,880714 \\ V_3 &= (0,969387755*0,35)+(0,98*0,25)+(0,75*0,25)+(1*0,15)= & 0,919286 \\ V_4 &= (0,979591837*0,35)+(0,97*0,25)+(1*0,25)+(1*0,15)= & 0,992857 \\ V_5 &= (0,989795918*0,35)+(1*0,25)+(0,75*0,25)+(0,75*0,15)= & 0,891429 \\ V_6 &= (0,959183673*0,35)+(0,98*0,25)+(1*0,25)+(1*0,15)= & 0,975714 \\ V_7 &= (0,969387755*0,35)+(0,96*0,25)+(1*0,25)+(0,75*0,15)= & 0,944286 \\ V_8 &= (0,979591837*0,35)+(0,97*0,25)+(1*0,25)+(1*0,15)= & 0,982857 \\ V_9 &= (0,959183673*0,35)+(0,96*0,25)+(0,75*0,25)+(0,75*0,15)= & 0,883214 \\ V_{10} &= (0,979591837*0,35)+(0,99*0,25)+(0,75*0,25)+(0,75*0,15)= & 0,885357 \\ V_{11} &= (0,969387755*0,35)+(0,97*0,25)+(1*0,25)+(1*0,15)= & 0,984286 \\ V_{12} &= (0,989795918*0,35)+(0,98*0,25)+(0,75*0,25)+(1*0,15)= & 0,923929 \end{aligned}$$

After obtaining the preference score, it then determines the calculation of each alternative prospective student. The results of alternative rankings can be seen in table 4 below

Table 4. Rank Student

Student	V Value	Rank
Anggraini Putri Liana	0,95	5
Boni Sandria	0,880714	12
Hendi Kurniawan	0,919286	8
M. Pebi Ramadhan	0,992857	1
Nopebrian Saputra	0,891429	9
Ida Firdaus	0,975714	4
Rindu Apriliana Pertiwi	0,944286	6
Aldo Al Farigi	0,982857	3
Diki Rosandy	0,883214	11
Sila Rianto Wijaya	0,885357	10
Adittyo Yunanta	0,984286	2
Ardian Yusuf	0,923929	7

Fadila Shely Amalia : *corresponding author



Copyright © 2023, Fadila Shelly Amalia, Debby Alita.

From table 4, the results of the decision support system for determining exemplary students using the SAW method for Rank 1 were obtained by M. Pebi Ramadhan with a value of 0.992857. Rank 2 was obtained by Adittyo Yunanta with a value of 0.984286. Rank 3 was obtained by Aldo Al Farigi with a value of 0.982857.

4. CONCLUSION

The decision support system for determining exemplary students using the SAW method is a solution to existing problems so that the results of the assessment of exemplary students become more effective and efficient in terms of time and selection of exemplary students. Decision-making in the determination of exemplary students can be more detailed and more accurate from existing candidates to truly exemplary prospective students who meet the established criteria. This SAW method can help teachers in making decisions using weights that have been determined by the school.

5. REFERENCES

- [1] D. A. Megawaty, S. Setiawansyah, D. Alita, and P. S. Dewi, "Teknologi dalam pengelolaan administrasi keuangan komite sekolah untuk meningkatkan transparansi keuangan," *Riau J. Empower.*, vol. 4, no. 2, pp. 95–104, 2021.
- [2] D. D. APRIYANI, "Sistem Pendukung Keputusan Pemilihan Siswa Berprestasi Menggunakan Metode Profile Matching," *Fakt. Exacta*, vol. 14, no. 1, p. 44, 2021, doi: 10.30998/faktorexacta.v14i1.9057.
- [3] V. H. Valentino, H. S. Setiawan, A. Saputra, Y. Haryanto, and A. S. Putra, "Decision support system for thesis session pass recommendation using AHP (analytic hierarchy process) method," *Int. J. Educ. Res. Soc. Sci.*, vol. 2, no. 1, pp. 215–221, 2021.
- [4] R. Aldisa, F. Nugroho, M. Mesran, S. A. Sinaga, and K. Sussolaikah, "Sistem Pendukung Keputusan Menentukan Sales Terbaik Menerapkan Metode Simple Additive Weighting (SAW)," *J. Inf. Syst. Res.*, vol. 3, no. 4 SE-Articles, Jul. 2022, doi: 10.47065/josh.v3i4.1955.
- [5] R. Tullah, A. R. Mariana, and D. Baskoro, "Sistem Pendukung Keputusan Pemilihan Calon Penerima Beasiswa Bidikmisi Menggunakan Metode AHP dan TOPSIS Pada STMIK Bina Sarana Global," *J. Sisfotek Glob.*, vol. 8, no. 2, 2018.
- [6] H. Asnal, M. Efendi, T. A. Fitri, and M. K. Anam, "Sistem Pendukung Keputusan Penunjukan Supplier Pengadaan Perangkat Kesehatan Pada Instalasi Farmasi RSUD Arifin Achmad Pekanbaru Dengan Metode Multifactor Evaluation Process," *SATIN-Sains dan Teknol. Inf.*, vol. 6, no. 1, pp. 98–105, 2020.
- [7] Y. Siagian *et al.*, "Analisis Sistem Pendukung Keputusan Menentukan Produk Terlaris dengan Metode Simple Additive Weighting," *J. Sains Komput. Inform. (J-SAKTI)*, vol. 5, no. 2, p. 1085, 2021.
- [8] M. A. D. Lestari and A. Widjaja, "Penerapan Aplikasi Sistem Penunjang Keputusan Performa Karyawan Outsourcing Terbaik Departemen IT Development Menggunakan Metode Simple Additive Weighting (SAW) Pada PT. Edi Indonesia," *IDEALIS Indones. J. Inf. Syst.*, vol. 5, no. 2, pp. 108–117, 2022.
- [9] M. R. Ramadhan, M. K. Nizam, and M. Mesran, "Penerapan Metode SAW (Simple Additive Weighting) Dalam Pemilihan Siswa-Siswi Berprestasi Pada Sekolah SMK Swasta Mustafa," *TIN Terap. Inform. Nusant.*, vol. 1, no. 9, pp. 459–471, 2021.
- [10] R. Cornaleus, A. Diana, and D. Achadiani, "Penerapan Metode Analytical Hierarchy Process Dan Simple Additive Weighting Untuk Pendukung Keputusan Dalam Penentuan Supplier," *ikraith-informatika*, vol. 6, no. 3, pp. 132–140, 2022.
- [11] A. Surahman and N. Nursadi, "Sistem Pendukung Keputusan Kenaikan Gaji Karyawan Dengan Metode Topsis Berbasis Web," *JTKSI (Jurnal Teknol. Komput. dan Sist. Informasi)*, vol. 2, no. 3, pp. 82–87, 2019.
- [12] A. Surahman, A. D. Wahyudi, A. D. Putra, S. Sintaro, and I. Pangestu, "Perbandingan

- Kualitas 3D Objek Tugu Budaya Saibatin Berdasarkan Posisi Gambar Fotogrametri Jarak Dekat," *InfoTekJar J. Nas. Inform. dan Teknol. Jar.*, vol. 5, no. 2, 2021.
- [13] Refiza, "Penerapan Metode Simple Additive Weighting," *Indones. J. Comput. Inf. Technol.*, vol. 4, no. 2, pp. 96–103, 2019, [Online]. Available: <https://ejournal.bsi.ac.id/ejurnal/index.php/ijcit/article/viewFile/426/324%0Ahttp://ejournal.bsi.ac.id/ejurnal/index.php/ijcit/article/download/426/324>.
- [14] M. A. Abdullah, I. Fitri, and N. D. Nathasia, "Sistem Pendukung Keputusan untuk Menentukan Hasil Bisnis Pujasera Terbaik dimasa Pandemi Covid 19 dengan Metode Fuzzy Tahani dan Simple Additive Weighting (SAW) berbasis Website (Studi Kasus: Pujasera Hangout Salihara)," *J. JTIC (Jurnal Teknol. Inf. dan Komunikasi)*, vol. 5, no. 1, p. 97, 2020, doi: 10.35870/jtik.v5i1.202.
- [15] K. M. Sukiakhy, C. V. R. Jummi, and A. R. Utami, "Implementasi Metode SAW Dalam Sistem Pendukung Keputusan Pemilihan Karyawan Terbaik Pada PT. Cindyani Tiwi Lestari," *J. Sist. Inf. dan Sist. Komput.*, vol. 7, no. 1, pp. 13–22, 2022.