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Analysis of Simple Additive Weighting (SAW) Methods to Determine The Quality of Student Learning SMK Siti Banun

Dhera[1], Deci Irmayani[2], Angga Putra Juledi[3]

[1,2] Information Management, Faculty of Science and Technology, Labuhanbatu University, 21418, Indonesia
[3] Information Systems, Faculty of Science and Technology, Labuhanbatu University, 21418, Indonesia

E-mail: dhera2017888@gmail.com[1], deacyirmayani@gmail.com[2], Anggapj19@gmail.com[3]

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ABSTRACT

It is a daunting challenge to assess the accuracy of student learning quality. Many considerations must be taken into consideration when determining the accuracy of the degree of student learning efficiency. These criteria use to assess students' ability to learn consistently. Since there are so many ways to satisfy this criteria, deciding on the consistency standard of learning scores is problematic. The SAW (Simple Additive Weighting) process solves different parameters of decision-making problems. The SAW method is a multi-criteria decision-making method founded on the idea that the chosen solution must satisfy all criteria. The SAW technique is a multi-criteria decision-making approach based on the optimal option, which would be the nearest to the ideal solution while being the furthest from the negative ideal solution. Calculating the normalization matrix, weighted normalization matrix, comparing the positive and negative ideal solutions, calculating the separation distance for each alternative ideal solution, and calculating the value of each alternative's preference are all steps in the SAW method. The following table displays the results of the SAW process calculation protocol. The information comes from a decision-making framework that distinguishes students who excel in their studies. Bunga Adelia Azahara received a 0.908, while Fadila Dwi Ranti received a 0.932.

1. Introduction

Humans must be interested in technical advancements, and technology has a significant impact on increasingly complicated daily life. Convenient technology-based devices have already become a staple in human existence. It will reduce the number of mistakes induced by human error or negligence while looking for information, and data security will be enhanced. Computerized systems must be paired with high-quality human capital in order to work according to human needs.

As technology advances, students often abuse it. Education develops along with technical progress. It can affect the level of education of children. Due to various problems in the educational environment, especially technical progress. The existing expectations of the school for children are being challenged. Many causes can damage educational standards. This is necessary to arouse students' curiosity in studying intensely with the use of technology.[1].

Enhance learning quality. Basic requirements for teaching personnel, students, house, venue, and curriculum are used to decide it. It may take the form of improving the level of student learning and providing high-quality learning opportunities for children. Multi-criteria dilemma criteria or multi-criteria decision making are other words about the same matter. As is the case in schooling, assessing and changing students' personalities to assess learning content is challenging. Decision-making involving several factors/parameters is referred to as decision-making with several criteria by teaching personnel confronted with problems affecting only one aspect.[2].

Decision-making is a form of comparatively abstract decision-making that includes one or more individuals making decisions based on various factors. Find the best answer to a dilemma. Each parameter has a particular meaning or weight. Simple Additive Weighting is one of the methods used to solve this problem (SAW).[3].

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2. Method

Decision support systems are information systems that include data simulation and manipulation (DSS). These structures help people making choices in a semi-structured and unstructured world where no one understands how to make them. Usually, a decision support mechanism created to aid with the solving of challenges.[4].

2.1 Metode Simple Additive Weighting (SAW)

The process of adding weight is often called the Simple Additive Weighting (SAW) method. The Simple Additive Weighting (SAW) approach's basic idea is to measure the cumulative weight of each option's performance score for all attributes.[5].

$$r_{ij} = \begin{cases} \frac{X_{ij}}{max X_{ij}\, i} \\ \frac{min X_{ij}\, i}{X_{ij}} \end{cases} \text{.....[5]}$$

Where rij is the alternative Ai's normalized efficiency ranking on attribute Cj; I = 1,2,..., m, and j = 1,2,..., n. The preference value (Vi) for each alternative is given as follows :

where:

rij = normalized work rating.

maxi = the maximum value for each row and column.

mini = each row and column's minimum value.

Xij= The matrix's rows and columns.

(rij) is the alternative's (Ai) normalized efficiency ranking at attribute (Cj) I = 1,2..., m and j = 1,2..., n.

$$\cdot\ V_i = \sum_{j=1}^{n} W_j r_{ij} \text{.....[5]}$$

A higher Vi value means that Ai is the preferable choice.

where:

Vi = the final value of the alternatives.

Wi = weights that have been determined.

rij = matrix normalization

A higher value means that a particular choice is favored..

The Simple Additive Weighting (SAW) process has many phases to it..

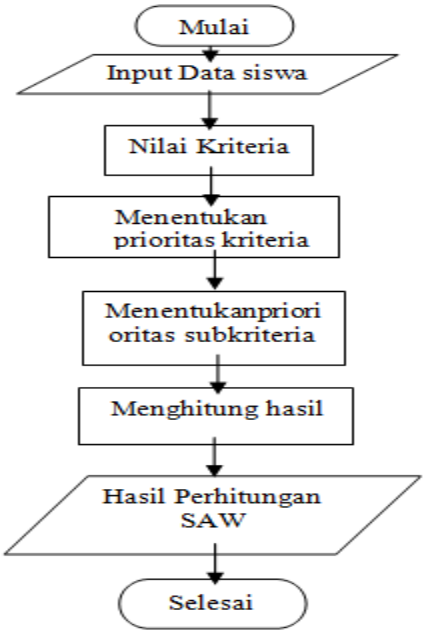

Fig 1. Flowchart for the Process of SAW Calculation Results

3. Results and Discussion

When evaluating students' assessment outcomes with a high degree of student learning satisfaction, many questions emerge. As mentioned in the introduction, SMK Siti Banun requires a decision-making mechanism that can make fast and correct decisions to decide the level of student learning. So far, making choices has taken a long time. Consequently, SMK Siti Banun needs a computer-based Decision Support Software to aid with improved decision-making and review. FMADM is the parameter that would be included in the scheme to determine the level of student learning.[6]. This is to see who would be preferred as a student who is willing to understand. The following are the school's eligibility requirements:

Table 1.
Criteria

Criteria	Description
C1	UAS Value
C2	UTS Value
C3	Extracurricular Value
C4	Presence

Determine the level of children's learning, the criteria used as measuring materials required at this stage. It is for deciding whom to pick as a student with a strong desire to understand. The standards that the school should take into account. Table 2 weights.

Tabel 2.
weights

Fuzzy Numbers	Value
Low (R)	1
Medium (S)	2
Height (T)	3
Very High (ST)	4

Each criteria's weight is determined by its relative value. The most significant considerations are UAS and UTS ratings, extracurricular grades, and student participation. The initial weight of each criteria (C1-C4) of each alternative is seen in the following table, based on the weighted significance of relevance for each criteria:

Table 3
weights for each initial criteria

Criteria	Weights
C1	1
C2	2
C3	3
C4	4

Five students from SMK Siti Banun were chosen as an indicator of how Fuzzy Multiple Attribute Decision Making (FMADM) can be used to determine students' learning levels while requirements are present. Table 4 contains the information from each student..

Table 4
Student Data

No	Student's NIS	Name	Value UAS	Value UTS	Value Extracurricular	Presence
1	0035715826	Fadila Dwi Ranti	80	75	90	75
2	0040612203	Bunga Adelia Azahara	75	80	75	70
3	0039331898	Arum Rama Novianti	80	70	75	90
4	0049722740	Hans Buma Rambe	85	75	75	70
5	3041252816	Nira Ritonga	70	65	80	65

Following the measures to evaluate student learning level utilizing the Fuzzy Multiple Attribute Decision Making (FMADM) method is what needs to achieve.:

a. On each predetermined On the UAS parameters, the average performance criteria, give the importance of each alternative (Ai) (Cj).

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1) Average score criteria UAS
   The alternate suitability ranking on the parameters is measured with one to four stars in the UAS average meaning variable :
   1 = Low
   2 = Medium
   3 = Height
   4 = very height
   Table 5 shows the alternatives' suitability ratings based on the UAS Value criteria.

Table 5
Average UAS Value

Average value UAS (C1)	Weighting of Value	Description
C1<= 60	0,20	Low
C1 = 61 – 70	0,25	Medium
C1 = 71 – 80	0,25	Height
C1 >= 81	0,30	Very height

2) Average score criteria UTS
   The alternative suitability on the parameters is evaluated with one to four data points, such as:
   1 = Low
   2 = Medium
   3 = Height
   4 = Very height
   Table 6 presents the suitability of the alternatives..

Table 6.
Average Value UTS.

Average Value UTS (C2)	Weighting Values	Description
C2<= 60	0,20	Low
C2= 61 – 70	0,25	Medium
C2 = 71 – 80	0,25	Height
C2>= 81	0,30	Very height

3) Average value on extracurricular criteria
   An extracuraeurricular average variable's suitability factor is graded from one to four :
   1 = Low
   2 = Medium
   3 = Height
   4 = Very height
   It can be observed in Table 7 in the table below..

Table 7
Average Value of Extracurricular

Average Value of Extracurricular (C3)	Weighting Values	Description
C3<= 60	0,20	Low
C3 = 61 – 70	0,25	Medium
C3 = 71 – 80	0,25	Height
C3 >= 81	0,30	Very height

4) Average value on Presence criteria
   In the variable average value Presence of alternate match rating on the criteria is assessed by one to four i.e. :
   1 = Low
   2 = Medium
   3 = Height
   4 = Very height
   The table below shows the match scores for the alternatives that are present.

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Table 8.
Average Value of Attendance

Average Value of Attendance (C4)	Value Weight	Description
C4 <= 60	0,20	Low
C4 = 61 – 70	0,25	Medium
C4 = 71 – 80	0,25	Height
C4 >= 81	0,30	Very height

For eg, in Table 9, the first student is A1, the second student is A2, the third student is A3, and the fourth student is A4. This table shows the suitability for each choice, with each variable below.

Table 9.
Suitability Rating of Each Alternative on Each Criteria.

Alternative	Criteria			
	C1	C2	C3	C4
A1	80	75	90	75
A2	75	80	75	70
A3	80	70	75	90
A4	85	75	75	70
A5	70	65	80	65

A decision matrix is constructed from Table 9 and then transformed into a table:

$$X = \begin{bmatrix} 70 & 65 & 80 & 65 \\ 75 & 80 & 75 & 70 \\ 80 & 70 & 75 & 90 \\ 85 & 75 & 75 & 70 \\ 80 & 75 & 90 & 75 \end{bmatrix}$$

b. Provide a Weight value (W).
To determine the Weight of the result value is formed in the table below.

Tabel 10
Weight

Criteria	Weight	Value
C1	Low	30%
C2	Height (T	25%
C3	cukup (C)	25%
C4	Low (R)	20%

From Table 10 obtained value Weight (W) with data: W =[1;2;3;4;5]

c. Normalize matrix X into matrix R based on equation 1.

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{\max\limits_{i} x_{ij}} & \text{Jika j adalah atribut keuntungan (}\textit{benefit}\text{)} \\ \dfrac{\min\limits_{i} x_{ij}}{x_{ij}} & \text{Jika j adalah atribut biaya (}\textit{cost}\text{)} \end{cases} \quad \text{…….[7]}$$

Description :
rij = normalized performance value rating
xij = value attributes owned from each criteria
Max xij = the greatest value of each criterion

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Min xij = the smallest value of each criterion
benefit = if the greatest value is best
cost = if the smallest value is best.
Normalization Results

$$\text{Matrix R}: \begin{bmatrix} 0.823 & 0.812 & 0.888 & 0.722 \\ 0.882 & 1 & 0.833 & 0.777 \\ 0.941 & 0.875 & 0.833 & 1 \\ 1 & 0.937 & 0.833 & 0.777 \\ 0.941 & 0.937 & 1 & 0.833 \end{bmatrix}$$

d. Conducting the process of determining the quality of students' learning by using equations (2):

$$V_i = \sum_{j=1}^{n} W_j r_{ij}$$

……[8]

Description :
Vi = rank for each alternative
wj = value Weight of each criteria
rij = normalized performance value rating
This process is done by multiplying the normalized matrix R with Value Weight W (W*R) is as follows:
W =[0.30 0.25 0.25 0.20]
V1 = (0.30)(0.823) + (0.25)(0.812) + (0.25)(0.888) + (0.20)(0.722)
= 0.246 + 0.203 + 0.222 + 0.144
= 0.815
V2 = (0.30)(0.882) + (0.25)(1) + (0.25)(0.833) + (0.20)(0.777)
= 0.264 + 0.25 + 0.208 + 0.155
= 0.877
V3 = (0.30)(0.941) + (0.20)(0.875) + (0.25)(0.833) + (0.20)(1)
= 0.282 + 0.218 + 0.208 + 0. 2
= 0.908
V4 = (0.30)(1) + (0.25)(0.937) + (0.25)(0.833) + (0.20)(0.777)
= 0.03 + 0.234 + 0.208 + 0.155
= 0.627
V5 = (0.30)(0.941) + (0.25)(0.937) + (0.25)(1) + (0.20)(0.833)
=0.282 + 0.234 + 0.25 + 0.166
= 0.932
The most significant value is in V5, so alternative A5 (Student 1) is chosen as the best choice. However, the best option is to find a few students who have a good level of quality learning in this situation.

Table 11
The best alternatives

No	Student NIS	Name	Final Result
1	0035715826	Fadila Dwi Ranti	0.932
2	0040612203	Bunga Adelia Azahara	0.908
3	0039331898	Arum Rama Novianti	0.877
4	0049722740	Hans Buma Rambe	0.815
5	3041252816	Nira Ritonga	0.627

The number of students who have been determined indicates that the method of assessment of students with the quality of learning is good. As for students who have a good level of learning quality are Fadila Dwi Ranti and Bunga Adelia Azahara.

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4. Conclusion

Simple Additive Scaling (SAS) is used for evaluating learning assessment practices. It would help schools to recognise students that satisfy the requirements. This approach may be referred to as the outcome of analysis and debate when dealing with student data from SMK Siti Banun may be referred to as a summation of their findings and conclusions Centered on the findings of the decision support system's review Students that have strong learning standard achieve a final score of 0.932 for Fadila Dwi Ranti and an alternative that is called bunga adelia azahara.

5. References

[1] y. Marryono jamun, "dampak teknologi terhadap pendidikan," *j. Pendidik. Dan kebud. Missio*, vol. 10, no. 1, pp. 48–52, jan. 2018.

[2] f. Dola syamsu, k. Hadi, and a. Razab, "meningkatkan kualitas pembelajaran dengan pendekatan berbasis saintifik pada materi keanekaragaman hayati," *bionatural j. Ilm. Pendidik. Biol.*, vol. 7, no. 2, sep. 2020.

[3] r. Kania, r. Effendi, and a. Risdiansyah, "sistem pendukung keputusan pemilihan karyawan teladan di universitas banten jaya menggunakan metode simple additive weighting (saw)," *j. Sist. Inf. Dan inform.*, vol. 4, no. 1, pp. 57–72, 2021, doi: 10.47080/simika.v4i1.1186.

[4] m. Hatta, "implementasi metode simple additive weighting pada sistem dss seleksi penerimaan beasiswa perguruan height," *j. Ilm. Intech inf. Technol. J. Umus*, vol. 2, no. 01, pp. 31–40, may 2020, doi: 10.46772/intech.v2i01.184.

[5] a. Setya putra, d. Rahma aryanti, and i. Hartati, "seminar nasional teknologi dan bisnis 2018 iib darmajaya bandar lampung," in *prosiding seminar nasional darmajaya*, nov. 2018, vol. 1, no. 1, pp. 85–97, [online]. Available: https://jurnal.darmajaya.ac.id/index.php/psnd/article/view/1233.

[6] h. A. Pradana, f. Fitriyani, and m. Marisa, "pengambilan keputusan pemilihan sekolah dasar islam menggunakan metode saw dan fmadm di pangkalpinang," *j. Sisfokom (sistem inf. Dan komputer)*, vol. 9, no. 1, p. 132, apr. 2020, doi: 10.32736/sisfokom.v9i1.840.

[7] t. Elizabeth, "sistem pendukung keputusan pemilihan asisten dosen menggunakan metode saw," *jatisi (jurnal tek. Inform. Dan sist. Informasi)*, vol. 7, no. 1, pp. 71–80, apr. 2020, doi: 10.35957/jatisi.v7i1.221.

[8] e. Ismanto and n. Effendi, "sistem pendukung keputusan penerimaan karyawan dengan metode simple additive weighting (saw)," *satin - sains dan teknol. Inf.*, vol. 3, no. 1, p. 1, jun. 2017, doi: 10.33372/stn.v3i1.208.

Accredited "Rank 4"(Sinta 4), DIKTI, No. 36/E/KPT/2019, December 13th 2019.