



Implementation of SAW Method in Scholarship Determination at YPN Medicom

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Abstract

To ease the burden of student tuition fees, AMIK Medicom provides a scholarship program. However, in the process of determining students who are entitled to receive scholarships, the institution experiences problems due to the large number of applicants, so that the selection process becomes ineffective and takes a long time. This research uses the Simple Additive Weighting (SAW) method as a solution to help the decision-making process. The SAW method was chosen because it is able to determine the best alternative from a number of candidates based on certain criteria, namely parents' income, number of children, number of dependents, place of residence, and academic grades. The results of the research show that this system is able to objectively rank students, making it easier for institutions to determine scholarship recipients more accurately and efficiently.

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1. Introduction

In optimizing daily human activities, the use of technology provides significant benefits and positive impacts. The rapid development of technology has had a significant impact on various fields, including politics, government, business, and the education sector. Access to information has also become faster and easier, particularly thanks to the support of computers, which have become an integral part of daily activities (Putra & Sari, 2020; Wijaya & Handayani, 2021). Especially in the process of awarding scholarships at educational institutions, computers assist operators and staff in processing data more efficiently, including in determining who is eligible to receive scholarships (Eniyati, 2011; Hidayat & Ramadhan, 2022).

To determine a student's eligibility as a scholarship recipient, criteria and selection rules are needed as the primary guidelines in the selection process. Common criteria include socioeconomic variables such as parental income, number of siblings, number of dependents in the family, living conditions, and academic performance, which are often used to assess eligibility objectively (Susanti, 2017; Rahmawati & Nugroho, 2021). With a large number of applicants and the diversity of indicators used, the selection process requires a system capable of handling data accurately and transparently (Maulidina & Cahyani, 2020; Fadillah & Prasetyo, 2019).

The Simple Additive Weighting (SAW) method is one of the popular methods used in decision support systems for scholarship selection. This method allows for the assignment of weights to each criterion, followed by a ranking process to determine the best alternative from a pool of candidates (Susanti, 2017; Nofriansyah, 2014). SAW is known for its simplicity in implementation and its ability to produce rational and measurable decisions, especially in multi-criteria decision-making (Azhari & Dewi, 2021; Rachmawati & Farida, 2022).

The implementation of the SAW method in a web-based system offers numerous advantages, such as ease of access, time efficiency, and transparency in the selection process. This system has the capability to process input data, perform calculations considering the weights and values of each defined criterion, and produce final results in the form of a priority ranking of students eligible for scholarships (Nurdin, 2014; Setiawan & Rini, 2020). Additionally, the digitization of this process reduces the potential for human error that may occur in manual processes while accelerating the reporting and documentation of selection results (Syamsuddin & Aditya, 2021; Fitria & Rasyid, 2020).

The SAW-based decision support system is also flexible and can be adapted to the policies of each educational institution. Adjustments to the criteria and weights within the system can be made flexibly, in line with institutional needs and the dynamics of internal policies in effect (Nofriansyah, 2014; Salsabila & Dini, 2023). The integration of this decision support system with the existing academic system can improve efficiency in the overall scholarship selection process, while ensuring the principles of fairness, accountability, and transparency in the distribution of educational assistance (Herlambang & Zulfikar, 2021; Anggraini & Maulana, 2022).

2. Research Methodology

The methods used in data collection are as follows:

- a. Observation is a data collection method that involves directly observing activities, behaviors, or symptoms that occur in natural or social situations. The aim is to obtain data systematically and objectively without interference from the researcher (Creswell, 2013). In this study, AMIK Medicom was chosen as the location to obtain valid results.
- b. To collect information that aligns with the participants' conditions and perspectives, a questionnaire was selected as an effective data collection method, presenting a series of written questions or statements that participants must complete directly. In this study, the questionnaire was distributed to 21 scholarship recipients. This questionnaire uses the Guttman scale, a hierarchical scale that allows participants to respond with 'yes' (value 1) or 'no' (value 0). With this approach, it is possible to determine the extent to which participants accept or believe each statement presented (Gothwal et al., 2009).
- c. Literature review is the stage of searching for and reviewing literature in the form of books, academic articles, and journals related to the research topic. This process involves identifying, evaluating, and synthesizing previous theories and findings to build a strong conceptual framework and map the knowledge gaps that will be filled in the current research (Sylvester et al., 2013).

In determining students eligible for scholarships, an analysis method is applied by inputting the specified criteria. In the decision-making system, the simple additive weighting method is proposed to address the issue of selection with many attributes. The normalization process of the decision matrix (X) to a scale that can be matched with all existing alternative ratings is required in the use of the simple additive weighting method. The formula used for normalization is as follows:

$$r_{ij} = \begin{cases} \frac{x_{ij}}{\text{Max}^{x_{ij}}}, & \text{If } J \text{ is the profit attribute} \\ \frac{\text{Min}^{x_{ij}}}{x_{ij}}, & \text{If } J \text{ exists; cost attributes} \end{cases} \quad (1)$$

With r_{ij} being the normalized performance rating of alternative A_i on attribute C_j : $i = 1, 2, \dots, m$ and $j = 1, 2, \dots, n$, Explanation: $\text{Max } X_{ij}$ = The largest value of each criterion i , $\text{Min } X_{ij}$ = The smallest value of each criterion i , X_{ij} = The attribute value of each criterion, Benefit = If the largest value is the best, Cost = If the smallest value is the best.

In testing data using formulas, an alternative formula is used, namely:

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

The preference value for each alternative (V_i) is given by the following formula: V_i = Ranking for each alternative. W_j = Weight value of the ranking (from each criterion). r_{ij} = Normalized performance value. A higher V_i value indicates that alternative A_i is more preferred (Nurdin, in Nofriansyah (2014: 12)).

3. Results and Discussion

The sample in this study consisted of 21 students from AMIK Medicom who were prospective students receiving scholarships. The sample was determined using purposive sampling, which is a method of determining samples based on specific parameters. The parameters for respondents in this study were students who would receive scholarships from the campus.

a. Analysis of Input and Output Needs

The input variables used are as follows: Parental income, Number of children, Number of dependents, Place of residence, Value. The preferences, from highest to lowest, constitute the output generated. The final result is obtained from the values of each parameter, as each parameter has a different weight.

b. Required Criteria and Weights

In conducting this study, there are weights and parameters required to determine which students will be selected to receive scholarships. The following table outlines the codes and criteria requirements:

Tabel 1 Table criteria

Code	Criteria table
C1	Parents' Income
C2	Number Of Siblings
C3	Number Of Dependents
C4	Student's Grades
C5	Place Of Residence

The specified weight sourced from each parameter/criterion. The weight consists of six fuzzy numbers, namely Very Good (SB), Good (B), Fairly Good (CB), Fair (C), Poor (K), and Very Poor (SK). As shown in the figure below:

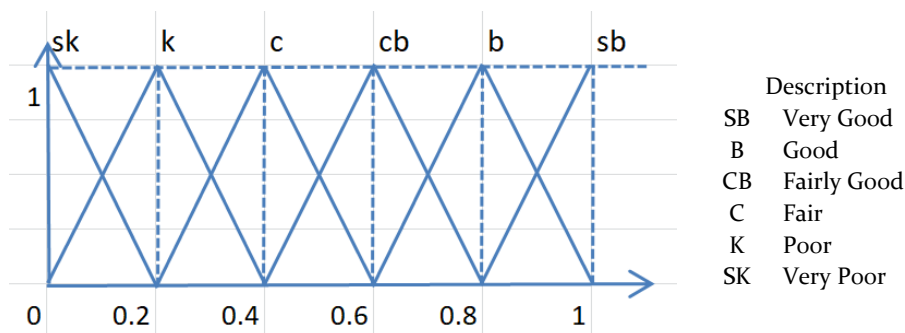


Figure 1. Fuzzy Numbers For Weights

The weightings available for each criterion are used to create a variable that will be converted into a fuzzy number using the formula variable $n/n-1$.

Table 2. Variables and weights (values)

Variable	Weight (Value)
Very poor (sk)	Variable $0/(6-1)=0$
Poor (k)	Variable $1/(6-1) = 1/5 = 0.2$
Fair (c)	Variable $2/(6-1) = 2/5 = 0.4$
Fairly good (Cb)	Variable $3/(6-1) = 3/5 = 0.6$
Good (b)	Variable $4/(6-1) = 4/5 = 0.8$
Very good (sb)	Variable $5/(6-1) = 5/5 = 1$

Table 3. Questionnaire Summary

Student data		Criteria				
No	Student name	C ₁	C ₂	C ₃	C ₄	C ₅
1	Margaret Tuter Artamora Sinaga	Rp 1.000.000	5 people	4	5 people	85
2	Samuel Bintang Saragih	Rp 2.750.000	2 people	2	2 people	70
3	Jastin Adyaksa S	Rp 2.250.000	2 people	2	2 people	83
4	Panca Saputra Nadeak	Rp 3.750.000	6 people	5	6 people	76
5	Sugi Wardino Sirait	Rp 1.000.000	3 people	3	3 people	90
6	Epy Tania Br Sinaga	Rp 2.500.000	4 people	4	4 people	92
7	Yohana Lamtiur Margaretha Gurning	Rp 2.250.000	4 people	4	4 people	88
8	Evrizal Gilang	Rp 3.000.000	4 people	3	4 people	76
9	Elsa Christiani Silalahi	Rp 2.000.000	4 people	3	4 people	87
10	Cindy Louisa Sihombing	Rp 2.000.000	3 people	3	3 people	89
11	Athallah Luthfi Salsabil	Rp 2.000.000	2 people	1	2 people	67
12	Selfi Manik	Rp 1.500.000	1 person	1	1 person	69
13	Diky Pratama	Rp 1.500.000	3 people	3	3 people	85
14	Feby Ester Ulina	Rp 1.750.000	2 people	2	2 people	90
15	Febrian Fernando Sihombing	Rp 3.000.000	3 people	3	3 people	92
16	Tito Kurnia Siregar	Rp 1.500.000	2 people	2	2 people	64
17	Siska Novianty Nasution	Rp 2.000.000	3 people	3	3 people	73
18	Dinda Arifah	Rp 1.500.000	2 people	2	2 people	70
19	Pitri Yani	Rp 1.000.000	6 people	5	6 people	77
20	Thessa Meilina Simamora	Rp 1.750.000	3 people	3	3 people	57
21	Roy Santi Banes Silaban	Rp 1.750.000	4 people	3	4 people	80

Table .4 Parents' income

Parental income (C ₁)	Variable	Weight
C ₁ < Rp. 100.000	very good	1
Rp. 100.000 < C ₁ < Rp. 500.000	good	0,8
Rp. 500.000 < C ₁ < Rp. 1.000.000	fairly good	0,6
Rp. 1.000.000 < C ₁ < Rp. 2.000.000	fair	0,4
Rp. 2.000.000 < C ₁ < Rp. 3.000.000	poor	0,2
Rp. 3.000.000 < C ₁ < Rp. 3.000.000	very poor	0

Table 5. Table Of Students Based On Weight

Code	Student name	Criteria				
		c ₁	c ₂	c ₃	c ₄	c ₅
c ₁	Margaret tutur artamora sinaga	0,6	0,8	0,6	0,8	1
c ₂	Samuel bintang saragih	0,2	0,2	0,2	0,4	1
c ₃	Jastin adyaksa s	0,2	0,2	0,2	0,8	0
c ₄	Panca saputra nadeak	0	1	0,8	0,6	1
c ₅	Sugi wardino sirait	0,6	0,4	0,4	0,8	1

c6	Epy tania br sinaga	0,2	0,6	0,6	1	1
c7	Yohana lamtiur margaretha gurning	0,2	0,6	0,6	0,8	1
c8	Evrizal gilang	0,2	0,6	0,4	0,6	1
c9	Elsa christiani silalahi	0,4	0,6	0,4	0,8	0
c10	Cindy louisa sihombing	0,2	0,4	0,4	0,8	0
c11	Athallah luthfi salsabil	0,2	0,2	0	0,4	0
c12	Selfi manik	0,4	0	0	0,4	1
c13	Diky pratama	0,4	0,4	0,4	0,8	1
c14	Feby ester ulina	0,4	0,2	0,2	0,8	0
c15	Febrian fernando sihombing	0	0,4	0,4	1	1
c16	Tito kurnia siregar	0,4	0,2	0,2	0,4	1
c17	Siska novianty nasution	0,2	0,4	0,4	0,6	0
c18	Dinda arifah	0,4	0,2	0,2	0,4	1
c19	Pitri yani	0,6	1	0,8	0,6	1
c20	Thessa meilina simamora	0,6	0,4	0,4	0,2	0
c21	Roy santi banes silaban	0,4	0,6	0,4	0,6	1

Table 6. Matrix Normalization

Code	Criteria				Value(c5)
	income (c1)	number of children (c2)	number of dependents (c3)	place of residence (c4)	
c1	1,00	0,80	0,75	0,80	1
c2	0,33	0,20	0,25	0,40	1
c3	0,33	0,20	0,25	0,80	0
c4	0,00	1,00	1,00	0,60	1
c5	1,00	0,40	0,50	0,80	1
c6	0,33	0,60	0,75	1,00	1
c7	0,33	0,60	0,75	0,80	1
c8	0,33	0,60	0,50	0,60	1
c9	0,67	0,60	0,50	0,80	0
c10	0,33	0,40	0,50	0,80	0
c11	0,33	0,20	0,00	0,40	0
c12	0,67	0,00	0,00	0,40	1
c13	0,67	0,40	0,50	0,80	1
c14	0,67	0,20	0,25	0,80	0
c15	0,00	0,40	0,50	1,00	1
c16	0,67	0,20	0,25	0,40	1
c17	0,33	0,40	0,50	0,60	0
c18	0,67	0,20	0,25	0,40	1
c19	1,00	1,00	1,00	0,60	1
c20	1,00	0,40	0,50	0,20	0
c21	0,67	0,60	0,50	0,60	1

Table 7. Final result

Code	Criteria				Value (c5)	Final grade
	income (c1)	number of children (c2)	number of dependents (c3)	place of residence (c4)		
c19	1,00	1,00	1,00	0,60	1	0,960
c1	1,00	0,80	0,75	0,80	1	0,868
c5	1,00	0,40	0,50	0,80	1	0,705
c4	0,00	1,00	1,00	0,60	1	0,660
c6	0,33	0,60	0,75	1,00	1	0,638
c21	0,67	0,60	0,50	0,60	1	0,635
c7	0,33	0,60	0,75	0,80	1	0,618
c13	0,67	0,40	0,50	0,80	1	0,605

c9	0,67	0,60	0,50	0,80	0	0,555
c20	1,00	0,40	0,50	0,20	0	0,545
c8	0,33	0,60	0,50	0,60	1	0,535
c16	0,67	0,20	0,25	0,40	1	0,453
c18	0,67	0,20	0,25	0,40	1	0,453
c15	0,00	0,40	0,50	1,00	1	0,425
c10	0,33	0,40	0,50	0,80	0	0,405
c14	0,67	0,20	0,25	0,80	0	0,393
c17	0,33	0,40	0,50	0,60	0	0,385
c2	0,33	0,20	0,25	0,40	1	0,353
c12	0,67	0,00	0,00	0,40	1	0,340
c3	0,33	0,20	0,25	0,80	0	0,293
c11	0,33	0,20	0,00	0,40	0	0,190

4. Conclusion

Based on the results of the study using the Simple Additive Weighting (SAW) method, it can be concluded that this method is effective as a decision-making tool in the scholarship recipient selection process, considering five main criteria: parental income, number of siblings, number of dependents, academic performance, and place of residence. Out of the 21 respondents analyzed, the student with code c19 (Pitri Yani) achieved the highest score of 0.960, indicating that the SAW method can provide objective and measurable results in prioritizing scholarship recipients. The normalization process and weighted calculations indicate that parental income and number of dependents are dominant factors in assessing economic eligibility. Overall, the application of the SAW method has proven to produce a transparent, fair, and accountable selection system, making it highly suitable for implementation in the context of competitive scholarship selection.

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