APPLICATION OF THE SMART METHOD FOR PROVIDING SCHOLARSHIPS IN HIGH SCHOOLS

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Abstract

Providing scholarships is an important step to support the nation's best sons and daughters in pursuing education up to the tertiary level. Many agencies and companies provide scholarships as a form of assistance to ensure the sustainability of the nation's next generation in the future. Nevertheless, the implementation of scholarships at the senior high school level still raises questions regarding conformity with the targets and criteria that have been set. This study aims to apply the Simple Multi Attribute Rating Technique (SMART) method in determining scholarship recipients for high school students. By using the SMART method, it is hoped that the selection process for scholarship recipients can be more effective and fair with the criteria used such as class ranking scores, parents' income, number of dependents on parents, and non-academic achievements. The end result of applying the SMART method is in the form of student rankings indicating their chances of getting a scholarship. The higher the ranking obtained, the greater the opportunity for students to receive scholarships, the highest ranking was achieved by student number 19 with an acquisition value of 97, indicating that this student is entitled to a scholarship. This study shows that the SMART method can be implemented in a decision support system to determine scholarship recipients for high school students.

Keywords: *Scholarships, SMART, Decision Support System*

1. INTRODUCTION

Providing scholarships is an important step to support the nation's best sons and daughters in pursuing education up to tertiary level. Scholarships are assistance given to students in each educational unit for educational participants who excel or for their parents who cannot afford to pay for their education.[1] However, the implementation of scholarships still raises questions regarding conformity with the targets and criteria that have been set. Distribution of scholarships so that they are right on target is very important and also requires a strategy[2], there are several factors to consider when making a decision¬¬¬in awarding scholarships, so that there are no errors in decision making which could result in the distribution of scholarships not being on target. This research uses quantitative data analysis techniques. Research using this technique uses a questionnaire that takes samples from the population as research subjects. Analysis of input needs is taken from data on prospective students who receive scholarships who have completed the required documents and then enter it into the system for decision making based on the criteria that have been determined, namely:

1. class Rank,
2. Parents' income/month,
3. Number of dependents of parents,
4. Non-academic achievements.

Decision Support Systems (DSS) are systems that can provide information and manipulate data to help decision makers.

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A Decision Support System is an information system that can process data and is used by organizations to help managerial parties solve semi-structured problems. Decision Support Systems (DSS) are information systems used to assist decision making in an organization or company.

2. RESEARCH METHODS

The method used to determine scholarship recipients is:Simple Multi Attribute Rating Technique (SMART). Simple Multi Attribute Rating Technique (SMART) is a method for dealing with multi-criteria problems in a decision support system developed in 1997 by Edward, so that the results of scholarship recipient selection are more relevant and effective. In the Simple Multi Attribute Rating Technique (SMART) method, attribute weighting is done in two steps that is :

1. Order the importance of an attribute from worst level to best level.
2. Make a comparison of the importance ratio of each attribute with the other attributes below it.

The steps for the Simple Multi Attribute Rating Technique (SMART) method as follows :

a) Determine the number of criteria
b) Carrying out Normalization.

$$Normalisasi = \frac{Wj}{\sum Wj}(1)$$

Where:

Wj = The weight of a criterion

$\sum Wj$ = Total weight of all criteria

c) Provide criteria values for each alternative.
d) Calculate the utility value for each respective criterion.

$$u_i(\alpha_i) = 100 \frac{(Couti-Cmin)}{(Cmax-Cmin)}(2)$$

Where:

$u_i(\alpha_i) =$ The utility value of the 1st criterion for the ith criterion
$C_{max} = Maximum\ criterion\ value$
$C_{min} = Minimum\ criteria\ value$
$C_{outi} = The\ i-th\ criterion\ value$

e) Calculate the final value of each

$$u(a_i) = \sum_{j=1}^{m} w_j u_i(a_i)\ (3)$$

Where:

$w_j = Weighting\ value\ of\ the\ jth\ and\ kth\ criteria$
$u(a_i) = Utility\ value\ of\ the\ ith\ criterion\ for\ the\ ith\ criterion$

This research is experimental in nature, namely by applying the Simple Multi Attribute Rating Technique (SMART) to determine scholarship recipients using the assessment results with predetermined criteria which are then processed using the Simple Multi Attribute Rating Technique (SMART) for decision making based on the four criteria specified. has been determined as follows:

1. class Rank,
2. Parents' income/month,
3. Number of dependents of parents,

4. Non-academic achievements.

This research approach is qualitative in nature, namely understanding how the Simple Multi Attribute Rating Technique (SMART) algorithm works, then the steps in the algorithm are used in manual calculation analysis to produce output in the form of ranking the assessment results using the four criteria to determine scholarship awards.

3. RESULTS AND DISCUSSION

The method used in this performance assessment isSimple Multi Attribute Rating Technique (SMART), here are the steps for applying the Simple Multi Attribute Rating Technique (SMART) method:

3.1 Determine the number of criteria weights

The initial step in the Simple Multi Attribute Rating Technique (SMART) method is to determine the number of weights for each criterion.The criteria used include four criteriaclass rank, parents' income/month, parents' income/month and non-academic achievementswith a total range of scores for weights of 100 points,as seen in Table 1.

Table 1. Table of total criteria weights

No.	Criteria Code	Criteria	Weight
1	C1	Class rank	50
2	C2	parents' income/month	20
3	C3	number of parental dependents	10
4	C4	non-academic achievements	20
		Total	100

Source: Research, 2023

3.2 Carrying out Normalization

Based on the weights that have been determined as seen in table 1, the next step is to normalize each criteria weight, using the following formula:

$Calculating\ normalization\ weights\ C1$:

$$Normalization = \frac{Wj}{\sum Wj}(4)$$

$$Normalization = \frac{10}{100}$$

$$Normalization = 0.1$$

Based on the results of these calculations, the weight for criterion C1 obtained is 0.1. Data from the calculation of normalized weights for each criterion C1 to criterion C10 is as shown in table 2.

Table 2. Normalization table for weights for each criterion

No.	Criteria Code	Criteria	Weight	Weight Normalization
1	C1	Class rank	50	0.5
2	C2	parents' income/month	20	0.2
3	C3	number of parental dependents	10	0.1
4	C4	non-academic achievements	20	0.2

Source: Research, 2023

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3.3 Provide criteria values for each alternative

Based on the criteria that have been determined, the next step is to determine the assessment category, the categories determined for each existing criterion include categories Very good with a value of 5, category Good with a value of 4, category Enough with a value of 3, category Currently with a value of 2 and a category Not enough with a value of 1, as seen in table 3.

Table 3. Table of determining categories for each criterion

No.	Criteria	Category	Mark	Weight
1	Class rank (C1)	Very good	5	50
		Good	4	
		Enough	3	
		Currently	2	
		Not enough	1	
2	parents' income/month (C2)	Very good	5	20
		Good	4	
		Enough	3	
		Currently	2	
		Not enough	1	
3	number of dependents of parents (C3)	Very good	5	10
		Good	4	
		Enough	3	
		Currently	2	
		Not enough	1	
4	non-academic achievements (C4)	Very good	5	20
		Good	4	
		Enough	3	
		Currently	2	
		Not enough	1	

Source: Research, 2023

After determining the assessment category, the next stage is data processing based on questionnaire data for prospective scholarship recipients. The questionnaire data for prospective Scholarship Recipients is as shown in Table 4.

Table 4. Questionnaire data for prospective scholarship recipients

No.	Prospective Scholarship Recipients	Class Rank (C1)	Parents' Income/month (C2)	Number of Dependents of Parents (C3)	Non-Academic Achievement (C4)
1	Student 1	5	5	4	1
2	Student 2	3	5	5	5
3	Student 3	5	3	3	3
4	Student 4	5	3	4	3
5	Student 5	4	1	4	5
6	Student 6	4	5	5	5
7	Student 7	5	1	4	5
8	Student 8	4	5	5	3
9	Student 9	3	1	2	5
10	Student 10	5	1	3	5
11	Student 11	5	2	4	5
12	Student 12	3	5	2	5
13	Student 13	5	4	5	5
14	Student 14	4	4	3	3
15	Student 15	3	4	4	3
16	Student 16	5	3	5	5
17	Student 17	5	4	3	5
18	Student 18	5	1	3	5

No.	Prospective Scholarship Recipients	Class Rank (C1)	Parents' Income/month (C2)	Number of Dependents of Parents (C3)	Non-Academic Achievement (C4)
19	Student 19	5	5	4	5
20	Student 20	5	4	4	5

Source: Research, 2023

Based on the questionnaire data for prospective scholarship recipients, the next stage is to determine the maximum value and minimum value for each criterion, The maximum and minimum values for each criterion are as shown in Table 5.

Table 5. Maximum and minimum values for each criterion

No.	Prospective Scholarship Recipients	Class Rank (C1)	Parents' Income/month (C2)	Number of Dependents of Parents (C3)	Non-Academic Achievement (C4)
1	Student 1	5	5	4	1
2	Student 2	3	5	5	5
3	Student 3	5	3	3	3
4	Student 4	5	3	4	3
5	Student 5	4	1	4	5
6	Student 6	4	5	5	5
7	Student 7	5	1	4	5
8	Student 8	4	5	5	3
9	Student 9	3	1	2	5
10	Student 10	5	1	3	5
11	Student 11	5	2	4	5
12	Student 12	3	5	2	5
13	Student 13	5	4	5	5
14	Student 14	4	4	3	3
15	Student 15	3	4	4	3
16	Student 16	5	3	5	5
17	Student 17	5	4	3	5
18	Student 18	5	1	3	5
19	Student 19	5	5	4	5
20	Student 20	5	4	4	5
	Maximum Value	5	5	5	5
	Minimum Value	3	1	2	1

Source: Research, 2023

3.4 Calculate the utility value for each respective criterion

The next step is to calculate the utility value for each respective criterion based on the maximum and minimum values contained in table 5.

Calculate Student 1's utility value from each value obtained on each criterion:

$$u_i(\alpha_i) = 100 \frac{(Cout_i - C_{min})}{(C_{max} - C_{min})} \qquad (5)$$

$$C1\ Student\ 1 = 100 \frac{(C1\ Student\ 1 - valuemin C1)}{(valuemax C1 - valuemin C1)}$$

$$C1\ Student\ 1 = 100 \frac{(5-3)}{(5-3)} = 100$$

$$C2\ Student\ 1 = 100 \frac{(C2\ Student\ 1 - valuemin C2)}{(valuemax C2 - valuemin C2)}$$

$$C2\ Student1 = 100 \frac{(5-1)}{(5-1)} = 100$$

$$C3\ Student\ 1 = 100 \frac{(C3\ Student\ 1 - valuemin C3)}{(valuemax C3 - valuemin C3)}$$

$$C3\ Student1 = 100 \frac{(4-2)}{(5-2)} = 67$$

$$C4\ Student\ 1 = 100 \frac{(C4\ Student\ 1 - valuemin C4)}{(valuemax C4 - valuemin C4)}$$

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$$\text{C4 Student } 1 = 100 \, \frac{(1-1)}{(5-1)} = 0$$

The utility calculation for each criterion will be carried out up to Student 20 data. The utility calculation data from Student 1 to Student 20 is as shown in table 6.

Table 6. Data on the results of Utility Calculations for each criterion for Student 1 to Student 20

No.	Prospective Scholarship Recipients	Class Rank	Parents' income/month	Number of Dependents of Parents	Non-Academic Achievement
1	Student 1	100	100	67	0
2	Student 2	0	100	100	100
3	Student 3	100	50	33	50
4	Student 4	100	50	67	50
5	Student 5	50	0	67	100
6	Student 6	50	100	100	100
7	Student 7	100	0	67	100
8	Student 8	50	100	100	50
9	Student 9	0	0	0	100
10	Student 10	100	0	33	100
11	Student 11	100	25	67	100
12	Student 12	0	100	0	100
13	Student 13	100	75	100	100
14	Student 14	50	75	33	50
15	Student 15	0	75	67	50
16	Student 16	100	50	100	100
17	Student 17	100	75	33	100
18	Student 18	100	0	33	100
19	Student 19	100	100	67	100
20	Student 20	100	75	67	100

Source: Research, 2023

3.5 Calculate the final value of each

The final step of the Simple Multi Attribute Rating Technique (SMART) method is to calculate the final value of eachprospective scholarship recipients.

$$u(a_i) = \sum_{j=1}^{m} w_j u_i(a_i) \quad (6)$$

Calculating the final score obtained by Student 1:

$$Student \ 1 = (100 \ x \ 0.5) + (100 \ x \ 0.2) + (67 \ x \ 0.1) + (0 \ x \ 0.2)$$
$$Student \ 1 = 77$$

The results of calculating Student 1's final score, the final score obtained was 77 points. The results of calculating the final grades from Student 1 to Student 20 are as shown in Table 7.

Table 7. Final Value for eachProspective scholarship recipients

No.	Prospective Scholarship Recipients	Class Rank (C1)	Parents' Income/month (C2)	Number of Dependents of Parents (C3)	Non-Academic Achievement (C4)	*Final score*
1	Student 1	100	100	67	0	77
2	Student 2	0	100	100	100	50
3	Student 3	100	50	33	50	73
4	Student 4	100	50	67	50	77
5	Student 5	50	0	67	100	52
6	Student 6	50	100	100	100	75
7	Student 7	100	0	67	100	77
8	Student 8	50	100	100	50	65

9	Student 9	0	0	0	100	20
10	Student 10	100	0	33	100	73
11	Student 11	100	25	67	100	82
12	Student 12	0	100	0	100	40
13	Student 13	100	75	100	100	95
14	Student 14	50	75	33	50	53
15	Student 15	0	75	67	50	32
16	Student 16	100	50	100	100	90
17	Student 17	100	75	33	100	88
18	Student 18	100	0	33	100	73
19	Student 19	100	100	67	100	97
20	Student 20	100	75	67	100	92

Source: Research, 2023

The next step in this final stage is to carry out rankings. By ranking, you will see the best scores obtained by prospective scholarship recipients, with ranking data as shown in Figure 1.

Source: Research, 2023

Figure 1. Graph of Data Ranking Results for Candidate Scholarship Recipients

The data ranking results for prospective scholarship recipients are shown in Figure 1. The highest ranking result was obtained by student with serial number 19, with the points he obtained being 97 points.

4. CONCLUSION

Based on the results of data processing of prospective scholarship recipients at Senior High Schools, it can be concluded that the results of data processing of prospective scholarship recipients using the Simple Multi Attribute Rating Technique (SMART) can be implemented in a decision support system for determining the award of scholarships to High School Students so that it can help authorities in making decisions in accordance with existing criteria. The research results showed that the highest score was obtained by student number 19 with 97 points and this student was entitled to receive a scholarship while studying at high school. For future research, it is hoped that we can implement the profile matching method in a Decision Support System by adding variables that can strengthen the assessment in determining the award of scholarships to high school students.

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