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SELECTION OUTSTANDING STUDENT USING MOORA METHOD

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Abstract

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In multi-criteria decision making, choosing the preferred alternative from among numerous alternatives is a classic challenge; approaches are required to provide decisions that are impartial. In this study, the Average Report Card Value (C1), Attitude Scores (C2), Attendance Scores (C3), Achievements (C4), and Extracurriculars (C5) were used to address the issue of outstanding student. To find the best alternative decisions for pupils who excel, 5 additional samples of students were chosen. For the purpose of resolving complicated mathematical issues arising from several opposing criteria qualities, the Multi-Objective Optimization on The Basic of Ratio Analysist (MOORA) method was selected. The results showed that alternative A4, which had a score of 0.49024595 and was the best alternative for excellent students, had the alternative ranking of outstanding students with the highest score.

Keywords: MOORA Method, Outstanding Student, DSS, Attribute Scoring Value

1. INTRODUCTION

Outstanding students are those who have achieved something in both academic and extracurricular areas that they are involved in at school and should be proud of. Everyone aspires to be a student who excels beyond their contemporaries[1]. Putting this into practice is more difficult than it first appears[2]. Outstanding students are often evaluated based on desired student learning outcomes, such as receiving outstanding grades or rising in their schools' overall rankings[3]. This is the benchmark by which exceptional students are assessed. Achievement in specific fields, such the arts, sports, or other disciplines, is another metric of success[4]. Every school has employed evaluations of every kind to identify the level of course achievement accomplished by specific students[5]. SMA PGRI 1 Denpasar, which has a program in place for choosing kids who thrive academically, is one among these.

Students that placed first through third were selected to take part in the program. In addition, the school will award students who win the championship with a certificate to honor their accomplishment. At SMA PGRI 1 Denpasar, each student's subject teacher is responsible for filling up a score sheet, which is then given to the student's homeroom teacher at the end of the marking session. The homeroom teacher then collects the grades submitted by the individual subject instructors into the appropriate areas of the report cards. However, filling in these scores is not easy and takes a considerable amount of time, and the selection procedure for high achievers requires evaluation of a huge number of criteria. The school determines how these criteria should be formed, and it takes a very long time to determine the results due to the large number of children who must be selected individually in order to determine which students are the most successful at the school[6]. The average value of students' report cards, attitudes, attendance, accomplishments, and engagement in extracurricular activities are the conditions for pupils to be labeled great students[7].

The objective of this research is to create a Decision Support System (DSS) application to address these problems. In order to make the best decisions, a decision support system is designed to

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manage student data and compared criteria more effectively. To identify exceptional students, the decision support system must employ the defined criteria[8]. The Multi-Objective Optimization on the Basis of Ratio Analysis (MOORA) method is used to determine the top students in each class[6][9]. The MOORA method is a multi-objective system that optimizes simultaneously two or more contradictory evaluation criteria[10]. This technique works by assigning a weight to each stated criterion to facilitate the selection of exceptional students based on a number of assessment criteria. The weighted assessment's top ranking results will be utilized to identify the top students[7]. By employing this method, it is hoped that the assessment would be more accurate because it is based on predetermined criteria and weights, resulting in more transparent and accurate conclusions when identifying great students.

2. METHOD

2.1 Definition of Achievement

Achievement is a key metric for measuring the outcomes of education. Success can be defined as the outcome attained. According to educational psychology, achievement is the degree to which a person possesses a particular skill or talent, such as reading and math aptitude[11]. The word "achievement" is frequently used in conjunction with other words, like "academic," "achievement level," and "achievement incentive." Achievement-affecting variables include internal variables, particularly physical and spiritual ones. Environments including the family environment, the school environment, and society have an impact on external elements[12].

2.2 Multi-Objective Optimization on The Basic of ratio Analysist (MOORA) Method

A multi-objective method called Multi-Objective Optimization on The Basic of Ratio Analysis (MOORA) simultaneously optimizes two or more attributes that are in conflict. This approach is used to address issues involving challenging mathematical calculations[13].

The subjective component of an evaluation process can be easily and flexibly divided into decision weight criteria with a variety of decision-making features using the MOORA approach. As a result of its ability to ascertain the intent behind competing criteria, this technique has a high level of selectivity. where the requirements may be advantageous (profitable) or negative (cost). The main steps of the MOORA approach are as follows[14][15]:

a. Identify the Evaluation Attributes and Alternative Suitability Ratings for Each Criteria.
   The initial step is to identify the objective and attribute evaluation value, as well as evaluate the acceptability of alternative values for each criterion.
b. Developing an X Decision Matrix
   The next step is to display attribute information in the form of a decision matrix (X).
c. Establishment of the Normalization Matrix

The Xij matrix, also known as the Xij ratio, represents the normalized value for each n criteria and each m alternative. Normalization is accomplished by calculating the value of the square root of the sum of the squares of the sum of the alternative values of each attribute. The calculation of the normalizing matrix is depicted as follows in Equation (1):

$$X^{*}ij = \frac{Xij}{\sqrt{[\sum_{i=1}^{m} x^{2}ij(\,j=1,2,\ldots n)]}} \quad (1)$$

Information:

xij is a matrix in the interval [0,1] which shows the normalized performance of alternative j on criterion i.
i : 1,2,3, ..., n is the sequence number of attributes or criteria
j : 1,2,3, ..., m is an alternative sequence number
X*ij : Alternative Normalization Matrix j on criteria

d. Optimisation of attributes

There is a multi-objective optimization process in place at this point, which means that each normalized attribute's performance will be increased if it is a benefit attribute and decreased if it is a

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cost attribute, or reduce the maximum and minimum values in each row to obtain a ranking on each row. Equation (2) below illustrates the attribute optimization calculation.

$$Y^i = \sum_{j=1}^{g} X^*ij - \sum_{j=g+1}^{n} X^*ij \quad (2)$$

Information:

g : maximized number of attributes

(n-g) is the minimized number of attributes

Yi is the normalized value of the nth alternative for all attributes.

e. Calculating The Alternative Ranking's Final Value

If the attribute optimization value has been acquired, the attribute optimization value is multiplied by the weight value of each attribute to determine the final value. Equation (2) displays the results of the following computation for the alternative ranking's final value:

$$\boldsymbol{Y^i = \sum_{j=1}^{g} Wj\, X^*ij - \sum_{j=g+1}^{n} Wj\, X^*ij} \quad (3)$$

Information:

Y^i is the value of the alternative normalization assessment i for all attributes

Wj is the weight against j

X^* ij denotes the -i order of the alternatives on the -j criterion

3. RESULTS AND DISCUSSION

3.1. DSS Model Overview

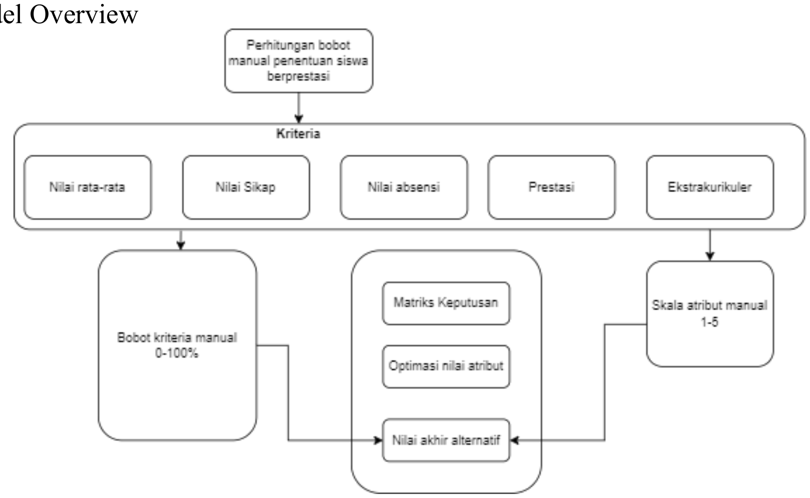

Figure 1. DSS Model Overview

Figure 1 shows that the interval (0–100%) is used by the person making the decision to figure out the weight of each criterion. In the next step, the value of the weight of the criteria is used to figure out the final alternative value. This is done in the MOORA method process. On the other hand, the manual attribute value scale is based on a value from 1 to 5.

3.2. Data Analysis

Based on interviews with the homeroom teacher, there are five assessment criteria used to identify excellent students: Average Report Card Value (C1), Attitude Scores (C2), Attendance Scores (C3), Achievements (C4), and Extracurriculars (C5). The procedure was performed to a sample of five student choices, namely Alternatives 1 (A1) through Alternatives 5 (A5). The decision maker determines the characteristic and value of the weight of the criteria.

Table 1. Criteria Detail

Criteria	Information	Characteristics of Criteria	Criteria Weight Value (%)
C1	Average Report Card Value	Benefit	35%
C2	Attitude Scores	Benefit	10%
C3	Attendance Scores	Benefit	25%

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C4	Achievements	Benefit	15%
C5	Extracurriculars	Benefit	15%

3.2. Criteria Attributes Determination

Each criterion has qualities that aid in scoring. If there is input criteria data in text form, attribute assessment is intended to find out the details of each criterion connected to the scoring process, or to assist decision makers' assessment if there are numerous attributes in the criteria with a rating scale of 1 to 5.

Table 2. Attribute Criteria C1

Criteria	Attribute Value	Information
C1	0-50	Very Bad
	>50-65	Enough
	>65-79	Well
	>79-100	Very Good

Table 3. Attribute Criteria C2

Criteria	Attribute Value	Information
C2	5	Very good
	4	Well
	3	Enough
	2	Bad
	1	Very bad

Table 4. Attribute Criteria C3

Criteria	Attribute Value	Information	Scale Value
C3	Sick	0-1	4
		>1-3	3
		>3-5	2
	Permission	0-1	3
		>1-3	2
		>3-5	1
	Alpa	0-1	2
		>1-3	1

Table 5. Attribute Criteria C4

Criteria	Attribute Value	Information	Scale Value
C4	Champion Rank	Number One Champion	5
		Runner Up	4
		3rd Place	3
		4th Place	2
		5th Place	1
	Championship Level	International	5
		National	4
		Province	3
		Local	2

Table 6. Attribute Criteria C5

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Criteria	Attribute Value	Information
C5	Active as Chairman	5
	Active as Vice Chairman	4
	Active as Secretary	3
	Active as Treasurer	3
	Active as a Member	2

3.3. Criteria Alternative Fit Rating

To calculate the MOORA technique, alternate data on each criterion must first be acquired. A decision matrix is typically used to describe the various values for each criterion.

Table 7. Alternative Values on Criteria

Alternative	Alternative Values on Criteria				
	C1	C2	C3	C4	C5
A1	73	5	4	2	1
A2	80	1	4	4	1
A3	75	11	4	2	4
A4	83	5	4	3	3
A5	76	11	5	2	1

3.3. MOORA Method Calculation

3.3.1. Alternative Value Normalization

Data from tables that have been transformed in accordance with Equation 1 are entered at this point to normalize the data. In each possibility, the value on each criterion is divided by the square root of the sum of the squares of each attribute on a criterion to generate the normalization value for the criteria for report cards (C1), attendance (C2), attitude (C3), achievement (C4), and extracurricular (C5). So that the following normalization value can be obtained:

$C1=\sqrt{73^2+80^2+75^2+83^2+76^2} = \sqrt{30,019} = 173,2599$
A11=73/173,2599=0,421332
A12=80/173,2599=0,461734
A13=75/173,2599=0,432876
A14=83/173,2599=0,479049
A15=76/173,2599=0,438647

$C2=\sqrt{5^2+1^2+11^2+5^2+11^2} = \sqrt{293} = 17,11724$
A21=5/17,11724=0,292103
A22=1/17,11724=0,058421
A23=11/17,11724=0,642627
A24=5/17,11724=0,292103
A25=11/17,11724=0,642627

$C3=\sqrt{4^2+4^2+4^2+4^2+5^2} = \sqrt{87} = 9,433981$
A31=4/9,433981=0,423999
A32=4/9,433981=0,423999
A33=4/9,433981=0,423999
A34=4/9,433981=0,423999
A35=5/9,433981=0,529999

$C4=\sqrt{2^2+4^2+2^2+3^2+2^2} = \sqrt{37} = 6,082763$

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A41=2/6,082763=0,328798
A42=4/6,082763=0,657596
A43=2/6,082763=0,328798
A44=3/6,082763=0,493197
A45=2/6,082763=0,328798

$C5=\sqrt{1^2+1^2+4^2+3^2+1^2} = \sqrt{28} = 5,291503$
A51=1/5.291503=0,188982
A52=1/5.291503=0,188982
A53=4/5.291503=0,755929
A54=3/5.291503=0,566947
A55=1/5.291503=0,188982

Table 8. Normalized Data

Alternative	C1	C2	C3	C4	C5
A1	0,421332	0,292103	0,423999	0,328798	0,188982
A2	0,461734	0,058421	0,423999	0,657596	0,188982
A3	0,432876	0,642627	0,423999	0,328798	0,755929
A4	0,479049	0,292103	0,423999	0,493197	0,566947
A5	0,438647	0,642627	0,529999	0,328798	0,188982

3.3.2. Weighted Normalization and Optimization

At this point, the normalized value of each alternative includes the weight of the criteria. Then, using Equation 2, determine the optimization value of each alternative by adding together all the benefit-related criteria and deducting all the cost-effective criteria.

The attribute will therefore need to be optimized before being multiplied by the weight of the criterion in a normalized search.

$$\begin{bmatrix} 0,421332(0,35) & 0,292103(0,10) & 0,423999(0,25) & 0,328798(0,15) & 0,188982(0,15) \\ 0,461734(0,35) & 0,058421(0,10) & 0,423999(0,25) & 0,657596(0,15) & 0,188982(0,15) \\ 0,432876(0,35) & 0,642627(0,10) & 0,423999(0,25) & 0,328798(0,15) & 0,566947\ (0,15) \\ 0,479049(0,35) & 0,292103(0,10) & 0,423999(0,25) & 0,493197(0,15) & 0,755929(0,15) \\ 0,438647(0,35) & 0,642627(0,10) & 0,529999(0,25) & 0,328798(0,15) & 0,188982(0,15) \end{bmatrix}$$

Multiplying the criteria weights results in a weighted normalization matrix, which can be seen in Table 9.

Table 9. Weighted Normalization

C1	C2	C3	C4	C5
0,1474662	0,0292103	0,1059975	0,0493197	0,0283473
0,1616069	0,0058421	0,1059975	0,0986394	0,0283473
0,1515066	0,0642627	0,1059975	0,0493197	0,08504205
0,1676671	0,0292103	0,1059975	0,0739795	0,11338935
0,1535264	0,0642627	0,1324975	0,0493197	0,0283473

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3.3.2. Optimization of Values after Weighted Normalization

In the subsequent stage, the normalized alternative values for each criterion are weighted and then combined in accordance with each alternative value to obtain the maximum value of the sum of each alternative row.

Table 10. Weighted Normalization

Alternative	C1	C2	C3	C4	C5	Max Value
A1	0,1535264	0,06426	0,13249975	0,0493197	0,0283473	0,36034325
A2	0,1474662	0,02921	0,10599975	0,0493197	0,0283473	0,40056115
A3	0,1616069	0,00584	0,10599975	0,0986394	0,0283473	0,45613083
A4	0,1515066	0,06426	0,10599975	0,0493197	0,08504205	0,49024595
A5	0,1676671	0,02921	0,10599975	0,0739795	0,11338935	0,42795585

3.3.2. Determination of Alternative Final Score

The alternative value for each criterion is based on the weighted normalization matrix for determining the final alternative value (Yi). Only the Max value is generated by adding the value of each option to each criterion because there are Max and Min values from the final value calculation method, which refers to Table 1 where all criteria are benefits. Because there are no cost criteria, the Min value is 0, and the Max value is then subtracted from the Min value to determine the final Yi value, which is then used to determine the ultimate value of each choice. Table 11 below shows the results of the alternate final value calculation.

Table 11. Alternative Final Value Calculation

Alternative	Max (C1+C2+C3+C4+C5)	Min	Y_i (Max – Min)
A1	0,36034325	0	0,36034325
A2	0,40056115	0	0,40056115
A3	0,45613083	0	0,45613083
A4	0,49024595	0	0,49024595
A5	0,42795585	0	0,42795585

The final step is to order the alternative values from greatest to smallest, according to Table 11 for the alternative values. Table 12 displays the ranking of possibilities.

Table 12. Ranking Of Alternatives

Alternative	Value	Rank
A4	0,49024595	1
A3	0,45613083	2
A5	0,42795585	3
A2	0,40056115	4
A1	0,36034325	5

From the alternative ranking results referring to Table 12, it is found that alternative A4 is the best alternative because it has the highest score of 0.49024595, so that alternative A4 becomes an alternative for outstanding students.

4. CONCLUSION

The findings of this research led the researchers to the conclusion that the scoring of attribute values using a rating technique based on a scale ranging from 1 to 5 may be utilized in the process of determining the alternative value intervals for each criterion attribute. The calculation process of the MOORA method is able to solve the problem of determining outstanding students by taking into

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account the nature of the criteria in determining the final value of the best alternative from five selected alternatives, based on five assessment criteria. This allows the MOORA method to solve the problem of determining outstanding students.

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