Decision support system for selection technique using MOORA method

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Abstract. This study aims to solve the problem of selecting the best students as recipients of the Academic Achievement Improvement scholarship at Sekolah Tinggi Akuntansi dan Manajemen Indonesia (STAMI). The scholarship data processing process carried out by STAMI is currently still using a manual process and only uses the GPA criteria only in determining scholarship recipients. This problem is resolved using a Decision Support System with the Multi-Objective Optimization based on Ratio Analysis (MOORA) method. The criteria used in this Decision Support System consist of: parents' income, parents' dependents, semester, and GPA. Alternative data used in this study consisted of 7 alternative STAMI students. The best ranking results from selecting the best students to obtain scholarships using the MOORA method are students with the STAMI_Student02 alternative with a ranking value of 0.2345.

1. Introduction
At this time, rapid development is not only developing in the aspects of hardware and software technology, but computing methods are also developing [1], [2], [3], [4]–[7], [8]. One of the computational methods of experiencing development at this time is the Decision Support System method. Through a decision support system, the solution to a problem can be taken by decision-makers through the selection of decisions that can be done easily and quickly [9]–[12].

Academic Achievement Improvement Scholarships in Indonesia are scholarships provided to increase equity and study opportunities for students who have difficulty paying their tuition fees due to a lack of economy, especially for students with academic achievements. Scholarships, in general, are the provision of tuition fees for students who are still actively studying and registered in the Ministry of Education and Culture's Database, as well as actively attending lectures at a university. The scholarship data selection process carried out by STAMI colleges currently only uses one criterion. Currently, to determine scholarship recipients, they are only selected from an academic perspective and have not used a decision-making method. As a result, the decision of the scholarship recipient to increase academic achievement seems subjective and does not give the right advice.

Based on the background of this problem, a decision support system was designed to facilitate selecting scholarship recipients on the STAMI campus so that the scholarship recipient's decision becomes objective. To get this scholarship, each student is selected based on established criteria,
consisting of GPA, Total Income of Parents, Number of Parents' Dependents, Semester, and has never received any scholarship from the local government. Therefore, not all students who apply for scholarships, only students who meet the criteria are eligible for scholarships adjusted to the scholarship acceptance quota.

The decision support system used to solve selecting students who receive scholarships to increase academic achievement is the MOORA method. The MOORA method can be used to overcome various problems in helping facilitate decision making [13]–[18]. With the existence of a decision support system designed at this College, Decision Makers can quickly determine the recipients of scholarships to increase academic achievement according to the eligibility of students in need.

2. Methodology
The method used for selecting recipients of PPA scholarship funds for students who are nominating for the scholarship is to use the MOORA method based on the criteria determined. The best alternative is obtained based on the value obtained to get a priority to become a scholarship recipient. The stages of research carried out in applying a decision support system for selecting the best students to obtain scholarships using the MOORA method are carried out in accordance with the steps, as shown in Figure 1.

The input data used in selecting student recipients of this academic achievement improvement scholarship are parents' income, the number of parents' dependents, semester, and cumulative grade point average (GPA). If the income level of the parents gets lower, the chances of getting a scholarship will be even greater. The more dependents of the student's parents who register, the greater the chance of getting scholarship. Students with the most excellent opportunity to get scholarships are active students with semesters 3 (three) and 5 (five). The higher the academic achievement of students who run for scholarships, the more excellent the opportunity to get scholarships.

3. Result and Discussion
Data analysis using the MOORA method consists of the following steps:

Determine the criteria value for a set of alternatives along with the weight of preference (Wj) for each criterion. The following is the weighting of the criteria and the value of each alternative's criteria.
that will be processed in the decision-making system to determine which students will receive scholarships for academic achievement improvement.

Table 3. Alternative Table And Score For Each Criterion

| Alternative | Student Name          | Parents' income | Parents' dependents | Semester | GPA  |
|-------------|-----------------------|-----------------|---------------------|----------|------|
| A1          | STAMI_Student01       | 1.5             | 3                   | 5        | 3.3  |
| A2          | STAMI_Student02       | 2               | 7                   | 5        | 3.35 |
| A3          | STAMI_Student03       | 3               | 1                   | 5        | 3.07 |
| A4          | STAMI_Student04       | 2.2             | 4                   | 5        | 3.5  |
| A5          | STAMI_Student05       | 2               | 5                   | 3        | 3.09 |
| A6          | STAMI_Student06       | 3.2             | 2                   | 3        | 3.48 |
| A7          | STAMI_Student07       | 2.775           | 3                   | 5        | 3.27 |

Based on the alternative data in Table 3, the next step is to normalize the matrix to calculate each criterion's value. The results of the Xij Normalized Decision Matrix calculation can be seen in the matrix below.

\[
\begin{bmatrix}
0.2314 & 0.2822 & 0.4181 & 0.3782 \\
0.3085 & 0.6585 & 0.4181 & 0.3839 \\
0.4627 & 0.0941 & 0.4181 & 0.3518 \\
0.3393 & 0.3763 & 0.4181 & 0.4011 \\
0.3085 & 0.4704 & 0.2509 & 0.3541 \\
0.4936 & 0.1881 & 0.2509 & 0.3988 \\
0.4280 & 0.2822 & 0.4181 & 0.3748
\end{bmatrix}
\]

The next stage is weighting the data from the normalization results above using the weights listed in table 2. The multiplication results of the Weighted Normalization Data can be seen in the matrix below.

\[
\begin{bmatrix}
0.0694 & 0.0564 & 0.0418 & 0.1513 \\
0.0925 & 0.1317 & 0.0418 & 0.1536 \\
0.1388 & 0.0188 & 0.0418 & 0.1407 \\
0.1018 & 0.0753 & 0.0418 & 0.1604 \\
0.0925 & 0.0941 & 0.0251 & 0.1416 \\
0.1481 & 0.0376 & 0.0251 & 0.1595 \\
0.1284 & 0.0564 & 0.0418 & 0.1499
\end{bmatrix}
\]

After the weighting has been completed, the next step is the sum of all the alternatives' criteria. The results can be seen in Table 4.

Table 4. Yi Values

| Alternative       | Max   | Min   | Yi (Max - Min) |
|-------------------|-------|-------|----------------|
| STAMI_Student01   | 0.2495| 0.0694| 0.1801         |
| STAMI_Student02   | 0.3271| 0.0925| 0.2345         |
| STAMI_Student03   | 0.2014| 0.1388| 0.0625         |
| STAMI_Student04   | 0.2775| 0.1018| 0.1757         |
| STAMI_Student05   | 0.2608| 0.0925| 0.1683         |
| STAMI_Student06   | 0.2222| 0.1481| 0.0742         |
| STAMI_Student07   | 0.2482| 0.1284| 0.1197         |
From the calculation of the value of Yi, the best ranking results are: STAMI_Student02 with the value of Yi = 0.2345. Ranking Result Graph can be seen visually in Figure 2.

![Figure 2. Ranking Result Graph](image)

4. Conclusion

Based on data processing using a decision support system for the selection of scholarship recipients to improve academic achievement at STAMI College using the MOORA method, it can be concluded that the process of selecting scholarship recipients can be done more easily and quickly. The application of DSS using the Moora method in the process of selecting student recipients of scholarships to increase academic achievement at the STAMI College is carried out using criteria consisting of parents' income, parents' dependents, semester and GPA.

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