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Selection of Outstanding Students Using AHP and Profile Matching

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ABSTRACT

The determination of outstanding students is the giving of awards to those who excel in academic and non-academic fields, aimed at motivating increased achievement. However, this process is often hampered by various criteria that must be considered, such as English language skills, work results, awards, and so on. The solution offered to overcome this problem is the development of a decision support system for selecting outstanding students using the AHP and Profile Matching methods. So, the aim of this research is to develop a decision support system for selecting outstanding students using a combination of the AHP and Profile matching methods, where later the system developed can assist decision makers in determining outstanding students. The results obtained from this research are a decision support system that uses 8 criteria and 26 alternative sample data which shows that "Student F" is an outstanding student with a score of 4.09. The results of manual calculations with the system show similarities, which shows that the system developed is in accordance with expectations.

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INTRODUCTION

Determining outstanding students is an effort to give awards to students who have excelled in academic and non-academic fields. This effort can also motivate students to improve their achievements. Currently, there are still several obstacles to determining outstanding students in decision making. These obstacles are caused by many criteria that are taken into consideration in making decisions such as English language skills, work results, awards received, competitions participated in and so on (Matindas et al., 2021). Therefore, a system is needed that can assist decision makers in determining outstanding students so that the results obtained are more objective and accurate.

A decision support system is a system used to assist in decision making (Setiawan & Budilaksono, 2022). Decision support systems have several methods such as the analytical hierarchy process (AHP) method (Masnuryatie & Triyono, 2022), Profile Matching (Siagian, 2020) and so on. AHP is a decision-making method that can be used to solve complex problems (Pambudi et al., 2021) (Rohmat & Kusrini, 2021). Meanwhile, profile matching is a method that can be used in decision support systems, where this method looks for the gap value between what is desired and what is available (Gustiana & Nia Sari, 2021) (Suarnatha, 2023).

In solving the problem of determining outstanding students, researchers will combine the Analytical Hierarchy Process (AHP) and Profile Matching methods as methods for decision making. The AHP method is used to determine the weight of the criteria used in selecting outstanding students, while the Profile Matching method is used to select alternative outstanding students based on predetermined criteria. The criteria used in this research refer to the criteria of the Guidebook for Selection of Outstanding Students in 2021(Matindas et al., 2021) such as organizational career, awards received, work results and so on.

There are several previous studies related to the topic under study, such as research conducted by Katili et al in 2021. This research discusses the selection of outstanding students using the AHP and TOPSIS methods. The results of this research are

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recommendations for which outstanding students will be selected (Katili et al., 2021). Another research is research conducted by Khasanah et al. This research focuses on developing a decision support system for determining outstanding graduate students using the AHP method (Khasanah et al., 2020). The next research is research conducted by Kurniawan et al. This research focuses on comparing methods in selecting outstanding students using the AHP, Electre and TOPSIS methods (Kurniawan et al., 2019). Another research was conducted by Siagian, in which the research applied the profile matching method in determining outstanding students (Siagian, 2020). And there are still other studies such as research by (Fadiah et al., 2023), (Malahayati et al., 2023), (Ikmah & Widawati, 2021), (Satrio et al., 2022) and others.

The difference between the research carried out and the previous one is that the research that will be carried out combines the AHP and Profile Matching methods in determining outstanding students with criteria referring to the guidebook for outstanding students in 2021 plus English language skills. The aim of this research is to develop a decision support system that applies the AHP method and profile matching in providing recommendations for determining outstanding students. With this research, it is hoped that decision making can be easier and more objective in determining outstanding students.

RESEARCH METHOD

In this research, there are two decision support system methods used, namely AHP and Profile Matching. The AHP method is used for weighting (Nata & Apridonal, 2020) and the Profile matching method for ranking (Fauzi et al., 2021) In the combination of these two methods, several stages were carried out in this research. These stages can be seen in Figure 1.

Figure 1 shows the research stages carried out in this study. The figure shows several stages starting from data collection, AHP (determining the level of importance between criteria, determining the comparison matrix, calculating eigenvalues, calculating CI and CR values), profile matching process (determining the target value for each criterion, determining the criteria values for each alternative, gap mapping, gap calculation), total value calculation, ranking.

1. Data Collection
   The data collected in this research is criteria data and alternative data.
2. AHP Process
   AHP in this study was used for weighting. In this research, the AHP stages carried out were determining the level of importance between criteria, determining the comparison matrix, calculating eigenvalues, calculating CI and CR values. The CR value must be less than 0.1, if it is more than the process will be repeated starting from determining the level of importance between criteria (Jufani et al., 2023).

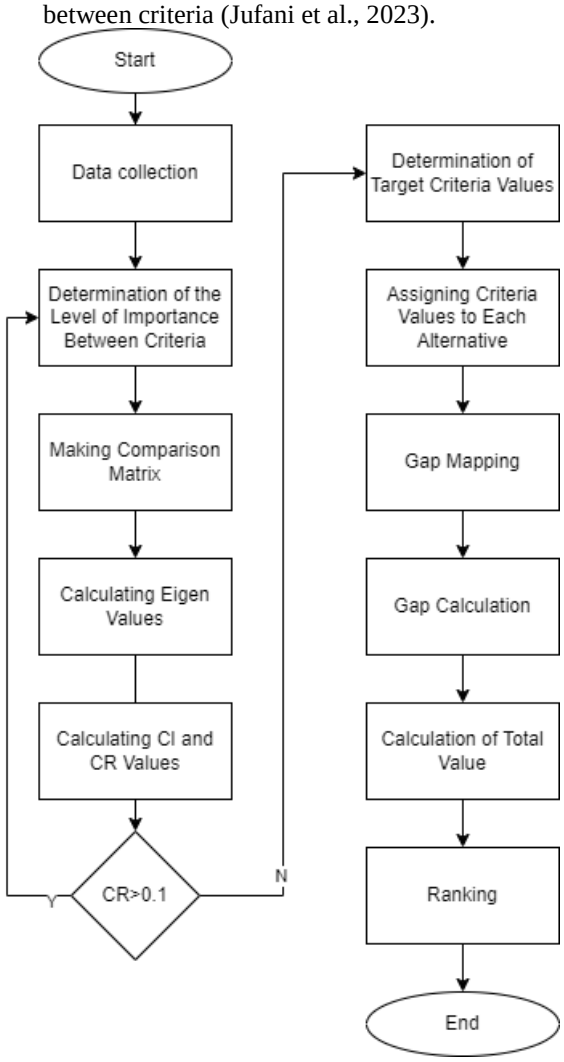

Figure 1. Research Stages

3. Profile Matching Process
   Profile Matching in this study was used to carry outranking. In this research, the profile matching stages carried out were determining the target value for each criterion, determining the criterion value for each alternative, gap mapping, gap calculation.
4. Calculation of Total Value
   After getting the weight value of the criteria using AHP and the value of each alternative using the Profile Matching method. The next stage is to calculate the alternative value with the criteria weight values and then add them up to get the total value.
5. Ranking
   The results of calculating the total value are then sorted from the highest value to get a ranking of alternative values.

RESULTS AND DISCUSSION

This research applies a combination of the AHP Decision Support System and Profile Matching

methods in developing a decision support system for determining outstanding students. This research uses data in the form of criteria and alternative data. The criteria data used in this research can be seen in Table 1.

Table 1. Data Criteria

Code	Criteria
C1	Competition
C2	Confession
C3	Award
C4	Organizational Career
C5	Masterpiece
C6	Empowerment
C7	Entrepreneurship
C8	English Language Ability

Table 1 shows the 8 criteria used in this research. Apart from criteria data, the data needed is alternative data. There is an alternative used in this research, namely sample data as shown in Table 2.

Table 2. Data Alternative

Code	Alternative
A1	Student A
A2	Student B
A3	Student C
A4	Student D
A5	Student E
A6	Student F
…..	…...
A26	Student Z

Table 2. Shows alternative data used in this research. This research uses 26 alternative data. After the data collection stage, the next stage is the stage of determining the level of importance between criteria based on the AHP process. The level of importance of the criteria used in this research uses Levels 1-9 (Sudiarjo & Hikmatyar, 2022). The level of importance of each criterion used in this research can be seen in Table 3.

Table 3. Level of Importance Between Criteria

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
C1	1,00	2,00	2,00	2,00	1,00	1,00	2,00	2,00
C2	0,50	1,00	2,00	1,00	2,00	2,00	1,00	3,00
C3	0,50	0,50	1,00	1,00	2,00	2,00	2,00	2,00
C4	0,50	1,00	1,00	1,00	2,00	2,00	0,50	1,00
C5	1,00	0,50	0,50	0,50	1,00	2,00	2,00	2,00
C6	1,00	0,50	0,50	0,50	0,50	1,00	1,00	1,00
C7	0,50	1,00	0,50	2,00	0,50	1,00	1,00	1,00
C8	0,50	0,33	0,50	1,00	0,50	1,00	1,00	1,00
	5,50	6,83	8,00	9,00	9,50	12,00	10,50	13,00

Table 3 shows the level of importance between criteria. The next stage is to create a normalization matrix. The results of the normalization matrix can be seen in Table 4.

Table 4. Shows the results of matrix normalization. After getting the normalization results, an eigenvalue search is carried out. The eigenvalue is obtained from the total value by multiplying the average value by the total value of each criterion in the comparison matrix. In this study, the maximum Eigen value was obtained at 8.64.

Table 4. Normalization Matrix

Criteria	C1	C2	C3	C4	C5	C6	C7	C8
C1	0,18	0,29	0,25	0,22	0,11	0,08	0,19	0,15
C2	0,09	0,15	0,25	0,11	0,21	0,17	0,10	0,23
C3	0,09	0,07	0,13	0,11	0,21	0,17	0,19	0,15
C4	0,09	0,15	0,13	0,11	0,21	0,17	0,05	0,08
C5	0,18	0,07	0,06	0,06	0,11	0,17	0,19	0,15
C6	0,18	0,07	0,06	0,06	0,05	0,08	0,10	0,08
C7	0,09	0,15	0,06	0,22	0,05	0,08	0,10	0,08
C8	0,09	0,05	0,06	0,11	0,05	0,08	0,10	0,08
	1	1	1	1	1	1	1	1

The average value which is the priority value for each criterion in this research can be seen in Table 5.

Tabel 5. Priority Value

Criteria	Priority
C1	0,184955
C2	0,162695
C3	0,140213
C4	0,121887
C5	0,123662
C6	0,085146
C7	0,103762
C8	0,077678

Table 5 shows the priority value for each criterion that has been obtained. The next stage is to calculate the CI value. To calculate the CI value, use Equation 1.

$$CI = \frac{Maks\ \lambda - n}{\mathrm{n} - 1} \quad (1)$$

Information:
Max λ = Maximum Eigenvalue
n = Number of Criteria

In this study, the CI value was 0.0919. The CI value is then used to find the CR value. The CR value is obtained from the CI value divided by the IR value, where the IR is obtained from the IR value provisions table (Oktapiani et al., 2020). Based on this table, the IR value in this research is 1.41 because the number of criteria used in this research is 8. So, the CR value in this research is 0.065, which is below 0.1, which means that the priority value or weight of each criterion can be declared consistent.

After getting the weight value for each criterion and a CR value of less than 0.1, the next stage is determining the target value for each criterion. The target values for each criterion can be seen in Table 6.

Tabel 6. Target Value

Criteria	Target Value
C1	5
C2	5
C3	5
C4	5
C5	5
C6	5
C7	5
C8	5

Table 6 shows the target value of each criterion. The next stage is to assign a value to each alternative for each criterion and then look for the gaps.

The results of the gap are then converted using the profile matching conversion method(Fahmi et al., 2019). The conversion results can be seen in Table 7.

Table 7. Profile Matching Conversion Results

Alternative	C1	C2	C3	C4	C5	C6	C7	C8
A1	4	3	3	3	3	3	3	4,5
A2	3	3	3,5	4,5	2	3	1	2
A3	2	1	3,5	4	2	2	1	2
A4	1	4	3	5	5	3	4	4
A5	2	5	3,5	2	4	3	3	5
A6	4	5	3,5	4,5	4	3	5	3
A7	1	5	4,5	2	3	4	2	2
A8	2	1	3	2	2	1	2	4,5
A9	2	5	4	5	2	5	2	5
A10	3	5	3,5	3	5	3	2	3
A11	2	3	4	5	3	2	3	4,5
A12	3	5	4,5	5	2	1	1	2
A13	5	2	3,5	2	5	1	2	4,5
A14	1	2	4	3	4,5	2	3	4,5
A15	1	5	3,5	4,5	2	2	5	5
A16	1	4	4,5	3	4,5	2	5	2
A17	3	4	4	5	4	5	4	4,5
A18	3	5	4,5	4	3	2	1	4
A19	5	2	3,5	4	2	4	2	2
A20	1	4	3	3	2	1	5	2
A21	3	3	3	2	3	4	4	5
A22	2	4	4	5	5	4	2	4,5
A23	4	3	3	3	3	1	5	4
A24	1	3	4,5	4	2	1	4	4
A25	5	4	5	4,5	4,5	2	1	5
A26	2	4	3	4,5	2	1	3	4,5

Table 7 shows the conversion results of the gaps obtained from profile matching. The next stage is the total value calculation stage where the total value is obtained from multiplying the gap conversion value with the weight value of each criterion from the AHP process which is then totaled to obtain the total value for each alternative. The total value is then sorted based on the highest value to get the ranking. The results of calculating the profile matching conversion value multiplied by the AHP weight value can be seen in Figure 2.

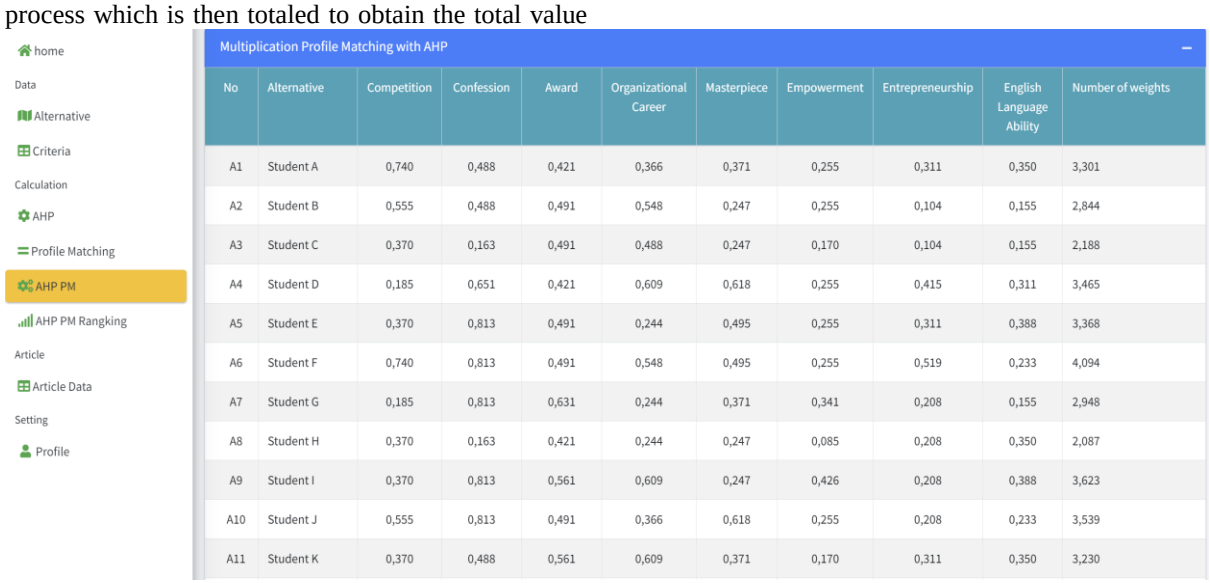

Figure 2. Profile Matching and AHP Calculation Results

Figure 2 shows the calculation results obtained from profile matching and AHP. The results of these calculations are then sorted based on the highest total score to obtain data on the students with the most achievements according to the criteria and data provided. The ranking results can be seen in Figure 3.

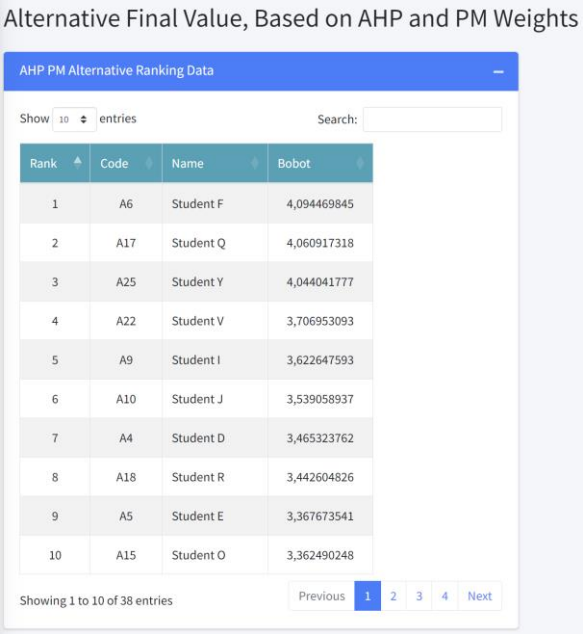

Figure 3. Ranking Result

Figure 3 shows the results of the ranking obtained, from which it was found that the student with the highest score was "Student F" with a score of 4.09. The ranking results shown are in accordance with the results of manual calculations carried out using the same data.

CONCLUSION

Based on the results of the research conducted, it was found that the decision support system for selecting outstanding students using a combination of AHP and Profile Matching methods was successfully developed. From this system it was found that the highest score obtained was 4.09 for "Student F". The test results carried out by comparing the results of the system with manual calculations show that the results of the system are in accordance with manual calculations. The suggestion for further research is that each criterion used needs to be made more complex so that the results obtained are more detailed. Apart from that, it is also necessary to combine methods with others to find out which one is better.

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