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Decision Support System for Selecting Outstanding Students at the Faculty Level in University Based on the GAP Method

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ABSTRACT

The aim of this study is to develop a Decision Support System (DSS) for selecting high-achieving students in one of the faculties at University X using the GAP analysis method. This analysis is used to identify the disparities between students' expectations regarding selection criteria and their actual performance. A survey was conducted with 100 active students to gather the necessary data. The study's findings reveal disparities between student's expectations and performance regarding academic achievement and participation in student organization activities. The use of a DSS based on the GAP analysis method enhances effectiveness and efficiency and reduces subjectivity in decision-making. The study results also present data before and after implementation using the GAP/Profile Matching Analysis application. In the pre-test results, there were 96 accurate data points and four inaccurate data points, with a percentage of 96%. The post-test results indicate 98 accurate data points and two inaccurate data points, with a percentage of 98%.

1. Background

Each year, one of the universities in Indonesia (University X) faces challenges related to the selection of outstanding students. An effective and efficient selection process is crucial to ensuring accurate results aligned with expectations[1]. Furthermore, the subsequent issue lies in the fact that the process of selecting outstanding students is not yet computerized, thus hindering decision-making processes.

Related to both of these issues, one solution is to develop a Decision Support System (DSS). This development would be computer-based, leveraging knowledge and information to aid in the decision-making process [2]. One of the relevant methods regarding the decision-making process is to apply gap analysis. This analysis measures the difference between the performance of existing variables and the user's expectations regarding those variables. Several previous studies have stated that businesses with good service levels tend to have smaller gaps [3].

In this study, a smaller gap between the established criteria and student achievements will result in a higher weight value. This condition indicates that students have a greater chance of being categorized as outstanding students. The criteria and assessment standards for outstanding students at University X are listed in Table 1.

Table 1. Criteria and Standard Values for Outstanding Students

No	Criteria	Standard Value
1	Grade Point Average (GPA) for the Semester	4
2	Competition Achievements	4
3	Article Publications	4

No	Criteria	Standard Value
4	Participation in Student Organization	4
5	Foreign Language Proficiency	4
6	Personality	4

Source: University X Policy

The main objective of this study is to develop a computerized DSS to support the selection process of outstanding students at one of the faculties in University X. The implementation of this DSS is expected to reduce errors in determining outstanding students and provide more accurate and efficient results.

The gap analysis in this study utilizes the measure of student satisfaction levels regarding the services provided by the faculty [4]. This measurement will yield appropriate rankings, accompanied by recommendations. The gap analysis approach employs the profile matching method, which involves decision-making mechanisms assuming an ideal profile that an object should possess. The profile serves as a predictor variable used as a benchmark for determining conformity [5], [6]. Broadly speaking, profile matching is a method that compares the actual data values of a record and evaluates them against expected profile values, resulting in differences (GAP). The smaller the deviation produces, the greater the weight of the value and the more opportunities for recommending selection [2]. Previous studies have applied the profile-matching method in decision-making in various educational institutions, such as selecting study programs [7], determining thesis supervisors [8], decision support systems for selecting outstanding teachers [9], and determining favorite lecturers [10]. Additionally, outside of educational institutions, the profile-matching method can also be applied to business entities, such as assessing the feasibility of Micro, Small, and Medium Enterprises (MSMEs) [11], the decision support system for determining the suitability of clove plantations [12], the decision support system for classifying MSMEs [5], and the feasibility of promotional decision support systems [13].

In relation to this study and several previous ones, it's evident that the use of DSS is crucial in decision-making [10]. Furthermore, gap analysis based on profile matching has proven to be a method capable of measuring service quality [11]. Based on these findings, this study is grounded in these concepts by integrating them into the development of the DSS for selecting outstanding students.

The results of this study are expected to provide a significant contribution to several faculties at University X in enhancing effectiveness and efficiency [14] in selecting outstanding students. The ranking results through the DSS will serve as a more accurate guide and can be justified in the decision-making process for selecting outstanding students. Additionally, the utilization of the gap analysis approach is expected to improve the quality of the faculty's services for several students.

2. Methodology

2.1. Data Collection

Data collection was conducted through a survey given to several students at University X. The measurement scale used was a Likert scale with intervals from 1 to 5, representing responses from "strongly disagree" to "strongly agree." The survey was administered directly to respondents from one of the faculties at University X. The sampling techniques employed were judgmental sampling, which involves selecting samples based on specific criteria, and judgmental sampling, which involves selecting samples based on specific criteria to provide the required information [15]. The criteria for respondents in this study are students who are scholarship recipients, actively involved in student organization activities, proficient in a foreign language, possess good personality traits, have published academic articles, have participated in competitions at least once, and have a semester Grade Point Average (GPA) of more than 3.50.

This study utilized a sample of 100 respondents with a data analysis technique employing profile matching. Based on the survey results, subsequent grouping is conducted based on core factors and

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secondary factors. The weights of criteria with core factors and secondary factors are listed in Table 2 as follows:

Table 2. Grouping of Core & Secondary Factor

Core Factor		
No	**Criteria**	**Types**
1.	GPA of Semester	CF
2.	Competition Participation	CF
3.	Involvement in Student Organizations	CF
4.	Foreign Language	CF
Secondary Factor		
1.	Article Publications	SF
2.	Personality	SF

Table 3 outlines how GPA values are classified into specific ranges and the corresponding values assigned to each range. It serves as a reference guide for evaluating students based on their academic performance.

Table 3. Weight of the GPA Criterion Values

GPA Range	Value
>3.61	4
3.41-3.60	3
3.21-3.40	2
2.50-3.20	1

2.2. Data Processing

Data processing in this study utilizes core factors and secondary factors, as listed in Table 4

Table 4. Results of Data Processing for 100 Students

No	Name	C1	C2	C3	C4	C5	C6
1.	Student 1	3.88	2	1	4	4	4
2.	Student 2	3.98	2	1	4	3	4
3.	Student 3	3.85	2	3	3	2	4
4.	Student 4	3.82	1	2	3	1	4
5.	Student 5	3.00	1	1	4	2	4
….	……..	…..	…..	….	….	….	….
100.	Student 100	3.90	3	0	4	4	4

Source: Data Processing Outcome

Explanation
C1 = GPA of Semester
C2 = Competition Participation
C3 = Article Publications
C4 = Involvement in Student Organizations
C5 = Foreign Language Proficiency
C6 = Personality

Respondent Explanation
0 = Never at all
1 = Once
2 = Twice
3 = Three times
4 = More than three times

2.3. Data Analysis Profile Matching Method

The stages in data analysis using the profile matching method begin with calculating the gap values for each criterion. The calculation process involves determining the difference in values between the profile of high-achieving prospective students who receive scholarships and the reference profile of

achievement used to qualify high-achieving students. The weight of each criterion has been determined by each faculty, with the calculation formula as follows:

$$\text{Gap} = \text{Student Profile} - \text{Achievement Profile} \quad (1)$$

The calculation results of the GAP are listed in Table 5 as follows:

Table 5. Calculation Results of GAP

No.	Name	C1	C2	C3	C4	C5	C6
1.	Student 1	4	2	1	4	4	4
2.	Student 2	4	2	1	4	3	4
3.	Student 3	4	2	3	3	2	4
4.	Student 4	4	1	2	3	1	4
5.	Student 5	1	1	1	4	2	4
….	……..	…..	…..	…..	…..	….	….
100.	Student 100	4	3	0	4	4	4
Achievement Profile		**4**	**4**	**4**	**4**	**4**	**4**
1.	Student 1	0	-2	-3	0	0	0
2.	Student 2	0	-2	-3	0	-1	0
3.	Student 3	0	-2	-1	-1	-2	0
4.	Student 4	0	-3	-2	-1	-3	0
5.	Student 5	-3	-3	-3	0	-2	0
…..	……..	…..	….	……	…..	…..	……..
100.	Student 100	0	-1	-4	0	0	0

Source: Data Processing Outcome

The next step is to perform weighting after obtaining the calculation of GAP values from each high-achieving prospective student. Each profile is assigned a weighted value as a benchmark against the GAP value, as listed in Table 6.

Table 6. Weighting of GAP Values

No	GAP Difference	Weight Value	Description
1.	0	6.0	Competency matched with requirements
2.	1	5.5	Competency exceeding level one
3.	-1	5.0	Competency deficiency level one
4.	2	4.5	Competency exceeding level two
5.	-2	4.0	Competency deficiency level two
6.	3	3.5	Competency exceeding level three
7.	-3	3.0	Competency deficiency level three
8.	4	2.5	Competency exceeding level four
9.	-4	2.0	Competency deficiency level four
10.	5	1.5	Competency exceeding level five
11.	-5	1.0	Competency deficiency level five

The weighting of the GAP values then results in the weighting of the GAP values for each high-achieving prospective student, as listed in Table 7

Table 7. Weighted GAP Values Result

No.	Name	C1	C2	C3	C4	C5	C6
GAP Difference Values							
1.	Student 1	0	-2	-3	0	0	0

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No.	Name	C1	C2	C3	C4	C5	C6
GAP Difference Values							
2.	Student 2	0	-2	-3	0	-1	0
3.	Student 3	0	-2	-1	-1	-2	0
4.	Student 4	0	-3	-2	-1	-3	0
5.	Student 5	-3	-3	-3	0	-2	0
…..	……..	…..	….	……	…..	…..	……..
100.	Student 100	0	-1	-4	0	0	0
Weighted GAP Values							
1.	Student 1	6	4	3	6	6	6
2.	Student 2	6	4	3	6	5	6
3.	Student 3	6	4	5	5	4	6
4.	Student 4	6	3	4	5	3	6
5.	Student 5	3	3	3	6	4	6
…..	……..	…..	….	……	…..	…..	……..
100.	Student 100	6	5	2	6	6	6

Source: Data Processing Outcome

The next step is to calculate the core factor and secondary factor values for the high-achieving student candidates. The calculation formula is as follows:

$$NFC = \frac{\sum \mathrm{NC}}{\sum \mathrm{IC}} \tag{2}$$

$$NSF = \frac{\sum \mathrm{NS}}{\sum \mathrm{IS}} \tag{3}$$

where NCF = Average Core Factor Value; $\sum NC$ = Total Sum of Core Factor Values; $\sum IC$ = Number of Core Factor Items; NSF = Average Secondary Factor Value; $\sum$ NS = Total Sum of Secondary Factor Values and $\sum IS$ = Number of Secondary Factor Items. The calculation results of the core factor and secondary factor values are listed in Table 8 as follows:

Table 8. Core Factor & Secondary Factor Value

No	Name	C1	C2	C3	C4	C5	C6	CF	SF
1.	Student 1	6	4	3	6	6	6	5.5	4.5
2.	Student 2	6	4	3	6	5	6	5.3	4.5
3.	Student 3	6	4	5	5	4	6	4.8	5.5
4.	Student 4	6	3	4	5	3	6	4.3	5.0
5.	Student 5	3	3	3	6	4	6	4.0	4.5
…..	…….	…..	….	…	…..	…..	…..	…..	….
100.	Student 100	6	5	2	6	6	6	5.3	5.5

The next step is to calculate the percentage of the core factor and secondary factor values. The percentage set by the faculty is 80% for the core factor and 20% for the secondary factor. The formulation for calculating the total value is as follows:

$$(\mathbf{1})(x)\%NCF + (\mathbf{2})(x)\%NSF = N \tag{4}$$

where NCF = Average Core Factor Value; NSF = Average Secondary Factor Value; N = Total Value of the Aspect and $(x)\%$ = Inputted Percentage Value. The calculation results of the percentage from the core factor and secondary factor values are listed in Table 9.

Table 9. Calculation of Total Value of High-Achieving Prospective Students

No	Name	Core Factor	Secondary Factor	N
1.	Student 1	5.5	4.5	5.3
2.	Student 2	5.3	4.5	5.1
3.	Student 3	4.8	5.5	4.9
4.	Student 4	4.3	5.0	4.4
5.	Student 5	4.0	4.5	4.1
…..	………..	……	……..	……
100.	Student 100	5.3	5.5	5.3

Source: Data Processing Outcome

Further, the values of each high-achieving prospective student are sorted from highest to lowest for the selection process. The selection criteria are as follows: if a high-achieving prospective student has a total score (core factor and secondary factor) ≥ 5.3, they are selected as high-achieving student candidates. Conversely, if the total score is < 5.3, they will not be considered as high-achieving students. The details of the score intervals for eligibility as high-achieving student candidates are listed in Table 10, as follows:

Table 10. Eligibility Score Intervals

Score Range	Description
< 5.3	Not High-Achieving
≥ 5.3	High-Achieving

Source: Data Processing Outcome

Based on the eligibility score intervals, the profile matching process is then arranged from the lowest score to the highest score, as listed in Table 11.

Table 11. Profile Matching Values

No.	Name	Score	Description
1	Student 10	3.0	Not High-Achieving
2	Student 11	3.5	Not High-Achieving
3	Student 26	3.7	Not High-Achieving
4	Student 85	4.0	Not High-Achieving
5	Student 30	4.2	Not High-Achieving
…..	……	……	………..
100	Student 8	5.3	High-Achieving

Source: Data Processing Outcome

3. Results and Discussion

3.1. Pre-System Implementation Testing

The respondents totaled 100 students who are candidates for high-achieving students. The pre-implementation testing results of the GAP analysis show that there are four candidates categorized as high-achieving students, with the remaining 96 students not falling into the high-achieving student category, as listed in Table 12.

Table 12. Pre-Test Result

No.	Name	Description	Should Be
1.	Student 1	High-Achieving	High-Achieving
2.	Student 2	Not High-Achieving	High-Achieving
3.	Student 3	Not High-Achieving	Not High-Achieving
4.	Student 4	Not High-Achieving	Not High-Achieving

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No.	Name	Description	Should Be
5.	Student 5	Not High-Achieving	Not High-Achieving
…	…….	……	……
100.	Student 100	Not High-Achieving	Not High-Achieving

Source: Data Processing Outcome

3.2. System Testing After Implementation

The testing results with the implementation of the profile matching-based application yielded the eligibility of five high-achieving student candidates, while the rest were not included as high-achieving student candidates.

Based on the testing results before and after the implementation of profile matching, there are differences. In the pre-test results, there were 96 accurate data and four inaccurate data. In the post-test results, there were 98 accurate data and two inaccurate data. The post-test results of the profile-matching implementation testing are listed in Table 13.

Table 13. Post-Test Results

No.	Name	Description
1.	Student 1	High-Achieving
2.	Student 2	Not High-Achieving
3.	Student 3	Not High-Achieving
4.	Student 4	Not High-Achieving
5.	Student 5	Not High-Achieving
….	……	…….
100.	Student 100	Not High-Achieving

Source: Data Processing Outcome

3.3. Pre-Test and Post-Test Comparison Testing

The validity testing results of the pre-test and post-test are continued with a comparison between them by applying the profile matching method, as follows:

Accuracy of pre-test data $\frac{96}{100}$ x 100% = 96%

Accuracy of post-test data $\frac{98}{100}$ x 100% = 98%

The accuracy calculation of both pre-test and post-test data yielded a higher percentage value for the post-test compared to the pre-test percentage.

4. Conclusion and Recommendations

Based on the analysis, design, and implementation of the profile-matching-based application program, the conclusions of this study are as follows, the implementation of the GAP-based application with the profile-matching method can assist users in making decisions related to the selection process of high-achieving students quickly, accurately, and objectively. According to the presentation of data before and after the implementation of the GAP-based application with the profile matching method, there are differences. In the pre-test results, four inaccurate data and 96 accurate data were obtained, with an accuracy percentage of 96%. In the post-test results, there were 98 accurate data with two inaccurate data. The accuracy percentage of the data is 98%.

In relation to the testing results before and after the implementation, this study can be continued by conducting a comparative study between the GAP method and other methods related to the selection of high-achieving students. Such comparisons will help in understanding the strengths and weaknesses of each method and gaining a deeper understanding of the effectiveness and efficiency of using the GAP method.

The results of this study can be further expanded to encompass more comprehensive selection criteria for high-achieving students, allowing for a more holistic decision-making process. The findings of this study can be used to explore advanced technologies such as artificial intelligence and machine learning in developing decision support systems. The utilization of such technologies could enhance precision and accuracy in determining the ranking of high-achieving students and expedite the decision-making process.

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