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Decision support system for selection of exemplary students using the analytical hierarchy process (AHP) method

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Abstract

The problem that occurs in determining exemplary students is the length of the process of determining the assessment of exemplary students, this is due to the fact that each teacher must first select potential exemplary students. After obtaining the names of prospective new model students, the selection of model students is carried out by an assessment team from the school. The purpose of this study is to select exemplary students at the end of each semester using the Analytical Hierarchy Process method. Based on the results of the assessment using the Analytical Hierarchy Process method, the first model student was obtained by Budi Riantono with a value of 0.250949, the second model student was obtained by Putri Azzahra with a value of 0.235755, the third model student was obtained by Akhmad Wijayanto with a value of 0.204881. The results of calculations between manual calculations and calculations using a web-based application show no difference in value and ranking. Then a web-based application is made based on the results of manual calculations using the Analytical Hierarchy Process method that has been made.

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1. Introduction

Model students in schools are usually determined through elections that involve all elements in the school. Starting from the principal and the leadership elements, the teacher assembly, all students and other school students. Students who deserve the nickname model students are students who can be used as examples and models for their friends. Exemplary students invite their friends to behave, behave and look through their personal examples and examples. The criteria for exemplary students include complying with the rules and regulations in school, studying diligently and reading books, being respectful and polite to all teachers, dressing and looking neat, speaking and speaking gently and pleasantly, and being liked by fellow students and teachers.

The problem in the selection of model students in schools is that there is no decision support system model used in determining model students. Another problem that exists is difficult in determining model students because the assessment is based on the results of the assessment from the homeroom teacher, so the school has difficulty in making a decision.

Decision Support Systems (DSS) are part of a knowledge-based computer-based information system used to support decision making within an organization or company [1]. DSS can also be regarded as a computer system that processes data into information in making decisions on specific semi-structured problems [2]. DSS has the aim of providing information, guiding, providing predictions, and directing solution options to information users so they can make better decision-making[3]. The main components of this DSS consist of a database, model base, and user interface to facilitate the process of interaction between humans and computers [4], [5]. The stages of the process of making decisions, starting from the process of identification, design, selection of solutions, up to the stage of program implementation [6], [7].

AHP helps in determining the priority of several criteria by performing a pairwise comparative analysis of each criterion. The AHP method is a weighting method that is often used in designing performance measurement systems. In the performance management system, what is meant by these criteria is a key performance indicator. This method uses the assumption that objective strategies and key performance indicators in each perspective are independent of each other which is represented by the hierarchical structure of the performance measurement system. This assumption indirectly ignores the interrelationships in the strategy map that has been designed.

The Analytical Hierarchy Process method or often known as the AHP method is a method in a decision support system for solving a problem with a complex situation or condition that is not structured into several components that have a hierarchical structure [8]–[11]. This AHP method provides a subjective value about the relative importance of each variable, and determines which variable has a higher priority so that it can influence the outcome of a condition in problem solving [12], [13]. This AHP decision support system model will solve problems that have complex multi criteria so that it will form a hierarchy or level [14]–[16]. By using a hierarchy, a complex problem can be described in detail so that existing problems will be more structured and systematic in solving them. The AHP method becomes a decision model that provides an opportunity for its users to build an idea or idea from an existing problem so that they will get the desired solution from the existing problem [17]. The advantages of the AHP method include providing a unified model that will be easily understood by users in solving structured problems, providing a rating scale to measure in determining the priority of problem solving, having dependencies between elements in a system, and providing a system design in solve complex problems [18], [19].

Previous research on the use of AHP in decision making has been carried out by several researchers, including research on developing a decision support system for selecting the best students by implementing the AHP approach [20]. In this study the best students were determined based on criteria such as grades, attendance, skills, social and spiritual. Subsequent research regarding the application of AHP in the selection of outstanding students [21]. This study uses criteria including academic abilities, creativity, attitudes and activities. Furthermore, there is research that develops a system for selecting outstanding students using the AHP method [22]. The criteria used in this study are the average value of report cards, attendance, discipline and participation in competitions. The AHP method has advantages, namely having advantages including having a hierarchical structure, as a consequence of the selected criteria, down to the deepest sub-criteria, taking into account validity up to the tolerance limit for inconsistencies of various criteria and alternatives chosen by decision makers, taking into account the durability or durability of the output of decision-making sensitivity analysis.

The difference between this research and previous research [20]–[22], is that in this study in determining the quantitative scale a certain range of values is used, and this value will be selected by the decision maker to determine the value of pairwise comparisons between criteria. Because the AHP method for determining weight depends on a quantitative scale of comparison between criteria. In addition, this study uses criteria including Academic Value, Attitude, Discipline, Responsibility and Organization. Decision support systems that are built on a web basis, in order to facilitate use and access. In testing the system to ensure that the system built is in accordance with the requirements, this research uses tests based on user satisfaction.

2. Research Method

The research method provides an overview of the research design which includes the activities carried out, namely the procedures and steps that must be taken, the time of the research, the source of the data, and by what steps the data were obtained and then processed and analyzed. The stages of the research conducted can be seen in Figure 1. The following are the stages of research shown in Figure 1.

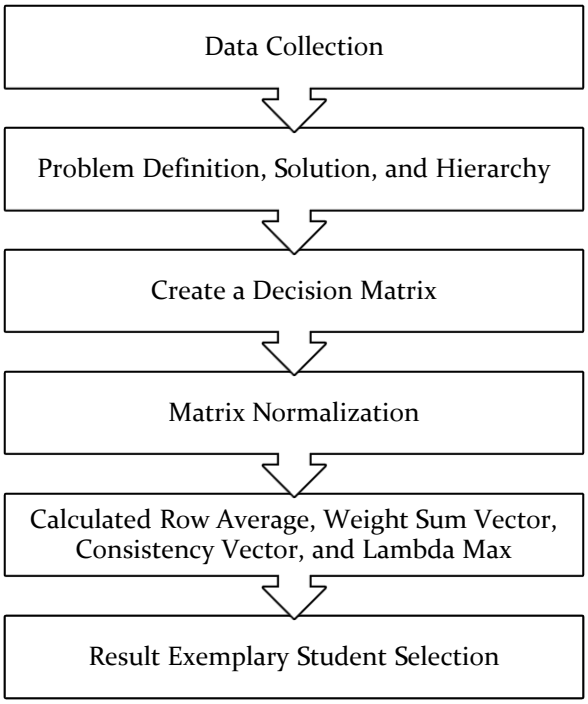


Figure 1. Research Stages

Explanation from figure 1 above is the above stages of research are carried out first data collection, then problem definition, solution and hierarchy. The next step is create a decision matrix, matrix normalization, and calculate row average, weight sum vector, consistency vector, lambda max. The next process is calculating consistency index, consistency ratio, and finally the results of exemplary student selection. The stages of the research carried out are as follows.

a. Data Collection
   Data collection was carried out in this study by conducting interviews at MAN ABCD to obtain information about the problem of determining exemplary students which is carried out at the end of each semester. The problem in determining exemplary students for each generation is that each teacher must provide recommendations for the names of students who will be the best student candidates, then a process will be carried out to determine exemplary students from each generation. The process of collecting research data uses a qualitative descriptive method, namely by collecting data used by schools, namely the criteria for academic value, attitude, discipline, responsibility, and organization.
b. Problem Definition, Solution and Hierarchy
   This stage will define the problem, namely the selection of model students. The solution that will be generated is the determination of model students, and the hierarchy of determining model students can be seen in Figure 2.

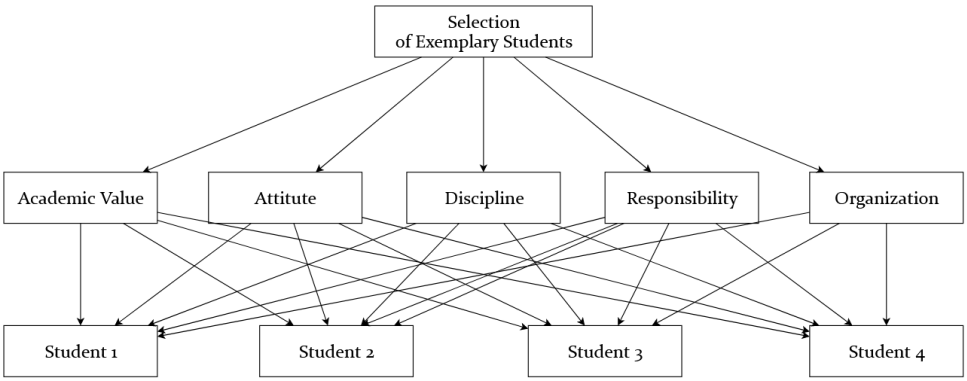


Figure 2. Hierarchical Structure of Selection of Model Students

Based on figure 2, the selection of exemplary students uses criteria of academic value, attitute, discipline, responsibility, and organization. These criteria will be used by each student in determining exemplary students.

c. Create a Decision Matrix

Assessment of criteria that are at each level of the hierarchy is given an assessment of the relative importance of one criterion to another [19], [23]. The hierarchical level of each criterion is carried out by a pairwise comparison, namely comparing each element with other elements [24], [25]. Each hierarchical level is paired so that the importance values of these elements are obtained in a qualitative form. In this study to determine the quantitative scale using an assessment with the following values: 1 (equally important); 3 (slightly more important); 5 (more important); 7 (very important); 9 (absolutely very important). Each criterion will be given a value obtained from the results of the school deliberation as a reference in determining pairwise comparisons between criteria. The following is a decision matrix based on the 5 criteria used. The following criteria data used are shown in Table 1.

Table 1.
Decision Matrix

Criteria	Academic Value	Attitute	Discipline	Responsibility	Organization
Academic Value	1	0.33	0.2	0.14	0.14
Attitute	3	1	3	5	3
Discipline	5	0.33	1	3	5
Responsibility	7	0.2	0.33	1	3
Organization	7	0.33	0.2	0.33	1
Total	23	2.2	4.73	9.48	12.14

Table 1 above shows the comparison matrix between the existing criteria used in the selection of exemplary students. Each criterion is compared with other criteria so as to get results in the form of a decision matrix. Based on the paired matrix above, we will normalize the paired matrix by dividing the matrix value by the total of each matrix column. The results of the normalized matrix can be seen in table 2.

Table 2.
Matrix Normalization

Criteria	Academic Value	Attitute	Discipline	Responsibility	Organization
Academic Value	0.04	0.15	0.04	0.02	0.01
Attitute	0.13	0.45	0.63	0.53	0.25
Discipline	0.22	0.15	0.21	0.32	0.41
Responsibility	0.3	0.09	0.07	0.11	0.25
Organization	0.3	0.15	0.04	0.04	0.08

Table 2 shows the results of matrix normalization based on matrix decisions. The results of matrix normalization will be a reference in the next process in calculating Calculated Row Average, Weight Sum Vector, Consistency Vector, and Lambda Max.

d. Calculated Row Average, Weight Sum Vector, Consistency Vector, and Lambda Max
The next step is to calculate the average row in the normalized matrix using equation (1) [26].

$$\boldsymbol{x} = \frac{\sum \boldsymbol{i}}{\boldsymbol{n}} \quad (1)$$

Based on formula (1), the value $\boldsymbol{x_{Academic\ Value}}$= 0.053; $\boldsymbol{x_{Attitute}}$=0.399; $\boldsymbol{x_{Discipline}}$=0.262; $\boldsymbol{x_{Responsibility}}$=0.164; $\boldsymbol{x_{Organization}}$ =0.123. The next step is to calculate the weight sum vector by multiplying the initial matrix with the row average, as follows:

$$\begin{bmatrix} \mathbf{0.04} & \mathbf{0.15} & \mathbf{0.04} & \mathbf{0.02} & \mathbf{0.01} \\ \mathbf{0.13} & \mathbf{0.45} & \mathbf{0.63} & \mathbf{0.53} & \mathbf{0.25} \\ \mathbf{0.22} & \mathbf{0.15} & \mathbf{0.21} & \mathbf{0.32} & \mathbf{0.41} \\ \mathbf{0.30} & \mathbf{0.09} & \mathbf{0.07} & \mathbf{0.11} & \mathbf{0.25} \\ \mathbf{0.30} & \mathbf{0.15} & \mathbf{0.04} & \mathbf{0.04} & \mathbf{0.08} \end{bmatrix} \times \begin{bmatrix} \mathbf{0.053} \\ \mathbf{0.339} \\ \mathbf{0.262} \\ \mathbf{0.164} \\ \mathbf{0.123} \end{bmatrix}$$

So that it produces a value of = 0.0777; = 0.4708; = 0.2297; = 0.1184; = 0.1034. The next step is to calculate the consistency vector by multiplying the weight sum vector by the row average as follows:

$$\begin{bmatrix} \begin{bmatrix} \mathbf{0.0777} \\ \mathbf{0.4708} \\ \mathbf{0.2297} \\ \mathbf{0.1184} \\ \mathbf{0.1034} \end{bmatrix} \end{bmatrix} \times \begin{bmatrix} \mathbf{0.053} \\ \mathbf{0.399} \\ \mathbf{0.262} \\ \mathbf{0.164} \\ \mathbf{0.123} \end{bmatrix} = \begin{bmatrix} \mathbf{0.0041} \\ \mathbf{0.1877} \\ \mathbf{0.0601} \\ \mathbf{0.0194} \\ \mathbf{0.0127} \end{bmatrix}$$

The next step is to calculate lambda max with equation (2).

$$\boldsymbol{\lambda_{max}} = \frac{\sum \boldsymbol{a}}{\boldsymbol{n}} \quad (2)$$

$$\lambda_{max} = \frac{(\mathbf{0.0041 + 0.1877 + 0.0601 + 0.0194 + 0.0127})}{\mathbf{5}} = \mathbf{0.284}$$

e. Calculating Consistency Index, and Consistency Ratio
At this stage, the value of the consistency index is calculated using equation (3).

$$\boldsymbol{CI} = \frac{\boldsymbol{\sum \lambda - n}}{\boldsymbol{n - 1}} \quad (3)$$

$$CI = \frac{0.284 - 5}{5 - 1} = \frac{-4.716}{4} = -1.179$$

At this stage, the calculation of the consistency ratio value is carried out with equation (4) [27], [28].

$$\boldsymbol{CR} = \frac{\boldsymbol{CI}}{\boldsymbol{RI}} \quad (4)$$

Where CR is the consistency ratio, CI is the consistency index, and RI is the random index. The CI value is obtained from the calculation of the consistency index in equation (3). While the value of RI is obtained based on random index values, the values are as follows: 1 = 0.00; 2 = 0.58; 3 = 1.90; 4 = 1.12; 5 = 1.24; 6 = 1.32; 7 = 1.41; 8 = 1.45; 9 = 1.49; 10 = 1.51; 11 = 1.48; 12 = 1.56; 13 = 1.57; 14 = 1.59; 15 = 0.00. Because the initial matrix used is a matrix with size 5, the IR value used is 1.24. So the calculation results to find the consistency ratio (CR) are as follows:

$$CR = \frac{-1.179}{1.24} = -0.9508$$

From the results of the CR value obtained, it shows that the CR value <0.1 means the CR value is

consistent, if the CR value is > 0.1 then you have to repeat from the first step [29], [30].

f. Result Exemplary Student Selection
After the CR value is declared consistent, then the weight that has been obtained is used to calculate the value of the model student candidate who will be selected as the model student.

3. Result and Discussion

To apply the Analytical Hierarchy Process (AHP) approach in the decision support system, the determination of exemplary students has the criteria of Academic Value, Attitute, Discipline, Responsibility, and Organization. Research related to the determination of exemplary students using AHP only uses the criteria of Academic Value, Attitute, and Discipline. So based on the results of discussions with the school, it proposed adding criteria, namely Responsibility, and Organization.

3.1. Implementation of the AHP Method

As a case study, there are 6 model student candidates to be selected, including: Putri Azzahra; Agus Widodo; Yuliana Sari; Ahmad; Wijayanto; Budi Riantono and Galih Purwanto. Each student will get a score from each of the existing criteria. The results of the comparative assessment between the 6 alternative academic value criteria are shown in Table 3.

Table 3.
Comparison Value for Academic Value Criteria

Academic Value Criteria	Putri Azzahra	Agus Widodo	Yuliana Sari	Akhmad Wijayanto	Budi Riantono	Galih Purwanto
Putri Azzahra	1	3	3	5	0.333	0.2
Agus Widodo	0.333	1	0.333	0.2	0.143	3
Yuliana Sari	0.333	3	1	5	0.2	0.2
Akhmad Wijayanto	0.2	5	0.2	1	3	5
Budi Riantono	3	7	5	0.333	1	7
Galih Purwanto	5	0.333	5	0.2	0.143	1
Total	9.867	19.333	14.533	11.733	4.819	16.400
Academic Value Normalization Results						
Putri Azzahra	0.101	0.155	0.206	0.426	0.069	0.012
Agus Widodo	0.034	0.052	0.023	0.017	0.030	0.183
Yuliana Sari	0.034	0.155	0.069	0.426	0.042	0.012
Akhmad Wijayanto	0.020	0.259	0.014	0.085	0.623	0.305
Budi Riantono	0.304	0.362	0.344	0.028	0.208	0.427
Galih Purwanto	0.507	0.017	0.344	0.017	0.030	0.061

Table 3 shows the comparative value for the academic score criteria of each student. Academic scores will be carried out a comparison process between students, after obtaining comparisons, matrix normalization will be carried out from academic score data.

The results of the comparative assessment between the 6 alternative academic value criteria are shown in Table 4.

Table 4.
Comparison Value for Attitude Criteria

Attitute Criteria	Putri Azzahra	Agus Widodo	Yuliana Sari	Akhmad Wijayanto	Budi Riantono	Galih Purwanto
Putri Azzahra	1	0.333	0.2	0.333	0.333	0.2
Agus Widodo	3	1	0.2	0.2	0.143	0.143
Yuliana Sari	5	5	1	0.333	0.2	0.143
Akhmad Wijayanto	3	5	3	1	0.143	1
Budi Riantono	3	7	5	7	1	1
Galih Purwanto	5	7	7	1	1	1
Total	1	0.333	0.2	0.333	0.333	0.2
Attitute Normalization Results						

Putri Azzahra	0.101	0.017	0.014	0.028	0.069	0.012
Agus Widodo	0.304	0.052	0.014	0.017	0.030	0.009
Yuliana Sari	0.507	0.259	0.069	0.028	0.042	0.009
Akhmad Wijayanto	0.304	0.259	0.206	0.085	0.030	0.061
Budi Riantono	0.304	0.362	0.344	0.597	0.208	0.061
Galih Purwanto	0.507	0.362	0.482	0.085	0.208	0.061

Table 4 shows the Comparison Value for the attitute Criteria of each student. The attitute value will be carried out in a comparison process between students, after the comparison is obtained, a matrix normalization will be carried out from the attitute value data.

The results of the comparative assessment between the 6 alternative discipline criteria are shown in Table 5.

Table 5.
Comparison Value for Discipline Criteria

Discipline Criteria	Putri Azzahra	Agus Widodo	Yuliana Sari	Akhmad Wijayanto	Budi Riantono	Galih Purwanto
Putri Azzahra	1	0.333	0.333	5	7	0.333
Agus Widodo	3	1	5	0.2	0.143	0.333
Yuliana Sari	3	3	1	5	0.2	5
Akhmad Wijayanto	0.2	7	0.2	1	3.000	7
Budi Riantono	0.143	0.333	5	0.333	1	7
Galih Purwanto	3	0.333	0.2	0.143	0.143	1
Total	1	0.333	0.333	5	7	0.333
Discipline Normalization Results						
Putri Azzahra	0.101	0.017	0.023	0.426	1.453	0.020
Agus Widodo	0.304	0.052	0.344	0.017	0.030	0.020
Yuliana Sari	0.304	0.155	0.069	0.426	0.042	0.305
Akhmad Wijayanto	0.020	0.362	0.014	0.085	0.623	0.427
Budi Riantono	0.014	0.017	0.344	0.028	0.208	0.427
Galih Purwanto	0.304	0.017	0.014	0.012	0.030	0.061

Table 5 shows the Comparison Value for the discipline criteria of each student. Discipline scores will be carried out a comparison process between students, after obtaining comparisons, matrix normalization will be carried out from discipline value data.

The results of the comparative assessment between the 6 alternative responsibility criteria are shown in Table 6.

Table 6.
Comparison Value for Responsibility Criteria

Responsibility Criteria	Putri Azzahra	Agus Widodo	Yuliana Sari	Akhmad Wijayanto	Budi Riantono	Galih Purwanto
Putri Azzahra	1	3	5	5	7	2
Agus Widodo	0.333	1	1	3	3	0.333
Yuliana Sari	0.200	1	1	5	1	7
Akhmad Wijayanto	0.2	0.333	0.2	1	1	5
Budi Riantono	0.143	0.333	1	1	1	1
Galih Purwanto	1	3	0.143	0.2	1	1
Total	1	3	5	5	7	2
Responsibility Normalization Results						
Putri Azzahra	0.101	0.155	0.344	0.426	1.453	0.122
Agus Widodo	0.034	0.052	0.069	0.256	0.623	0.020
Yuliana Sari	0.020	0.052	0.069	0.426	0.208	0.427
Akhmad Wijayanto	0.020	0.017	0.014	0.085	0.208	0.305
Budi Riantono	0.014	0.017	0.069	0.085	0.208	0.061
Galih Purwanto	0.101	0.155	0.010	0.017	0.208	0.061

Table 6 shows the comparative values for each student's responsibility criteria. The value of responsibility will be carried out a comparison process between students, after getting a comparison, a matrix of responsibility value data will be normalized.

The results of the comparative assessment between the 6 alternative organization criteria are shown in Table 7. below

Table 7.
Comparison Value for Organization Criteria

Organization Criteria	Putri Azzahra	Agus Widodo	Yuliana Sari	Akhmad Wijayanto	Budi Riantono	Galih Purwanto
Putri Azzahra	1	1	1	1	1	1
Agus Widodo	1	1	1	1	1	1
Yuliana Sari	1	1	1	1	1	1
Akhmad Wijayanto	1	1	1	1	1	1
Budi Riantono	1	1	1	1	1	1
Galih Purwanto	1	1	1	1	1	1
Total	1	1	1	1	1	1
Organization Normalization Results						
Putri Azzahra	0.101	0.052	0.069	0.085	0.208	0.061
Agus Widodo	0.101	0.052	0.069	0.085	0.208	0.061
Yuliana Sari	0.101	0.052	0.069	0.085	0.208	0.061
Akhmad Wijayanto	0.101	0.052	0.069	0.085	0.208	0.061
Budi Riantono	0.101	0.052	0.069	0.085	0.208	0.061
Galih Purwanto	0.101	0.052	0.069	0.085	0.208	0.061

Table 7 shows the comparative values for each student's organizational criteria. Organization values will be carried out a comparison process between students, after getting a comparison, a matrix normalization will be carried out from organization value data. After obtaining the normalized value of each alternative for the 5 criteria, the next step is to find the row average value of each alternative for each of the existing criteria. The results of the average value of each row of each alternative with existing criteria can be seen in Table 8.

Table 8.
Row Average Alternative

Student's Name	Academic Value	Attitute	Discipline	Responsibility	Organization
Putri Azzahra	0.194	0.048	0.408	0.520	0.115
Agus Widodo	0.068	0.085	0.153	0.211	0.115
Yuliana Sari	0.148	0.183	0.260	0.240	0.115
Akhmad Wijayanto	0.261	0.189	0.306	0.130	0.115
Budi Riantono	0.335	0.375	0.208	0.091	0.115
Galih Purwanto	0.195	0.341	0.088	0.092	0.115

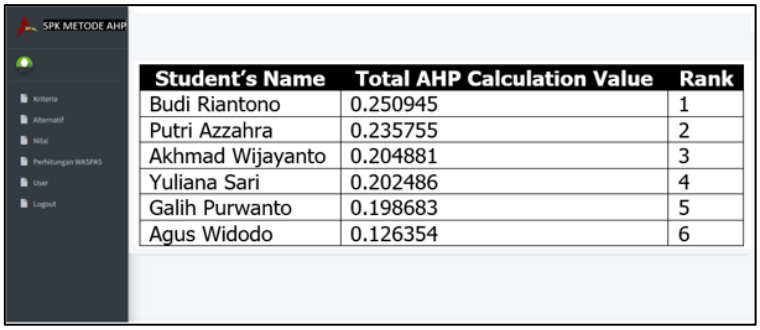
Table 8 shows the row averages of each student for all criteria used. After getting the average value of each row from each alternative with the existing criteria, then multiply it by the average row value of the criteria. After getting the final value, the last step is ranking each alternative, the ranking results for each alternative can be seen in the Table 16.

Table 9.
Exemplary Student Selection Ranking

Student's Name	Total AHP Calculation Value	Rank
Budi Riantono	0.250945	1
Putri Azzahra	0.235755	2
Akhmad Wijayanto	0.204881	3
Yuliana Sari	0.202486	4
Galih Purwanto	0.198683	5
Agus Widodo	0.126354	6

Table 9 shows the ranking value of the selection of exemplary students. The results of the assessment of exemplary students are applied using the AHP method, so that it will facilitate the school in making decisions. The results of the assessment calculation of Budi Riantono's exemplary students get rank 1, Princess Azzahra ranked 2nd. Akhmad Wijayanto got rank 3, Yuliana Sari got rank 4. Galih Purwanto got rank 5, and Agus Widodo got rank 6. Based on the results of the assessment using the AHP method, the first model student was obtained by Budi Riantono with grades 0.250949, the second model student was obtained by Putri Azzahra with grades 0.235755, the third model student was obtained by Akhmad Wijayanto with grades 0.204881.

The application display for the selection of exemplary students can be seen in Figure 3.



Student's Name	Total AHP Calculation Value	Rank
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Akhmad Wijayanto	0.204881	3
Yuliana Sari	0.202486	4
Galih Purwanto	0.198683	5
Agus Widodo	0.126354	6

Figure 3. Implementation of Calculation Applications Using AHP

Figure 3 above shows the results of calculations using a web-based application with the AHP method that have been made. The application makes it easy for schools to determine student models. By using this application, the school will be facilitated by automatic calculations using the AHP method. The results of calculations between manual calculations and calculations using a web-based application show no difference in value or ranking. Then the decision support system developed based on the calculation results is valid and can be used as a reference.

Based on the case studies and the calculation of decision settlement using the AHP method that has been carried out, it shows that the AHP method can decompose complex multi-factor or multi-criteria problems into a hierarchy. Then the importance level of each variable is given a subjective numerical value about the relative importance of this variable compared to other variables through a pairwise comparison matrix, which takes into account validity up to the tolerance limit for inconsistencies between various criteria and alternatives chosen based on the decision maker. So, this method can find the best solution that can be accounted for. This is in accordance with previous research showing that AHP is able to solve multi-criteria problems well [20]–[22]. However, the AHP method is very dependent on determining the weight depending on the quantitative scale of comparison between criteria. So in this study, in determining a quantitative scale, a certain value range is used, and this value will be chosen by the decision maker to determine the value of pairwise comparisons between criteria. So in determining the quantitative scale in this study, the assessment obtained from the results of the school deliberation is used as a reference in determining pairwise comparisons between criteria.

3.2. User Satisfaction Testing

Testing of this system is carried out to obtain assessment from the exemplary student selection application made. This test aims to determine the value of the application made whether it is in accordance with the needs of the school in determining exemplary students. There were 8 respondents who were users of this application, namely the Principal, Vice Principal, Vice Curriculum, and 5 Homeroom Teachers. The test questionnaire questions contain 10 questions with a range of values from 1 to 5. The test results are shown in Figure 4.

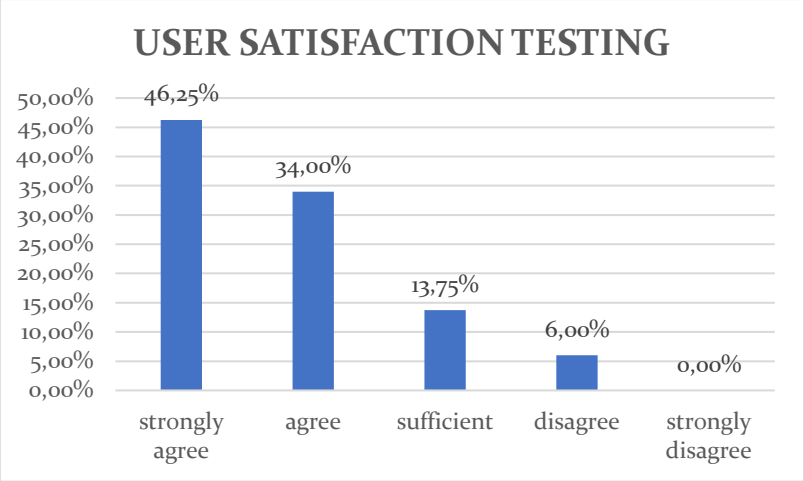

Figure 4. Result Questionnaire Testing Chart

Figure 4 describes the overall questionnaire results from each category: 46.25% strongly agree, 34% agree, 13.75% sufficient, 6% disagree, and 0% strongly disagree. Based on the results of the questionnaire testing, it can be concluded that the Decision Support System for the Determination of Exemplary Students using the Analytical Hierarchy Process (AHP) method is in accordance with the needs of the school and gets a good response from users so that it can be used in determining exemplary students at the end of each semester.

4. Conclusion

The decision support system for determining model students that was developed was implemented using the Analytical Hierarchy Process (AHP) method. Where the AHP method can describe complex multi-factor or multi-criteria problems into a hierarchy, then the level of importance of each variable is given a subjective numerical value to be compared with other variables through a pairwise comparison matrix. In order for the resulting pairwise comparison matrix to be used as a reference, determining the quantitative scale at the level of importance of the criteria becomes an important factor. In this study, the determination of a quantitative scale for each criterion was based on an assessment with a certain number range, and then the value of the level of importance was given to the head based on deliberation and the agreement of the interested parties. The decision support system is built on a website and has been tested based on user satisfaction testing, which shows that 46.25% strongly agree, 34% agree, 13.75% are sufficient, 6% disagree, and 0% strongly disagree. These results indicate that the application of model student determination is in accordance with the needs of the school. However, this study has limitations, namely that the accuracy test of the AHP method in determining decisions has not been carried out. So, future research can test the accuracy of the decision results of the AHP method in determining exemplary students and can use other multi-criteria methods to get the ideal decision-making method.

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