DEVELOMPENT OF WEB-BASED DECISION SUPPORT SYSTEM FOR SCHOLARSHIP RECIPIENTS SELECTION USING ANALYTICAL HIERARCHY PROCESS (AHP) METHOD

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ABSTRACT: The goal of this research was to produce a decision support system to solve a semistructured problem that was a determination of scholarship receiver. The system developed a Web-based Decision Support System, using the PHP programming language (PHP Hypertext Preprocessor) and based CodeIgniter Framework and MySQL as a Database Management System (DBMS). The method used in this system development is Analytical Hierarchy Process (AHP). This method will make a decision by breaking the problem into its parts, develop criteria into a hierarchy, determines the priority value of each criterion in the form of pair wise comparison matrix, performing synthesis to obtain the overall priorities, and measure the hierarchy ratio. From these steps will get the value of the priority criteria and sub-criteria that used to calculate the points students. Students with the highest points will be recommended by the school to get the scholarship.

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Keywords: Decision Support System, Analytical Hierarchy Process (AHP), Scholarship, PHP, CodeIgniter

1. INTRODUCTION

Education has a very important role in life. The development of a nation can not be separated from the education system, because a good education system will bring progress for the nation. With human education has knowledge, values, and attitudes in doing to participate to support the growth and development needed by himself, society, nation, and state.

The government realizes that education is very important for the community. So the government supports every citizen to achieve education with the declaration of 9-year compulsory education. Not only that, even the government also provides assistance in the form of scholarships to free education.

The scholarship is one of the government programs, private companies, embassies, universities, and educational institutions or researchers to improve the quality of education in Indonesia. Gerdon (2011: 165) states that "the scholarship is the income for the receiving and the purpose of the scholarship is to help ease the burden of tuition fees of students or students who get". With the scholarship program is expected to ease the economic burden of achieving students but economically disadvantaged to be able to continue education.

Scholarship grants are still using different variables/indicators in each agency. So it is not uncommon to see a child who has the same poverty level but with different priorities in receiving scholarships. It is this that underlies the decision support system developed to help semiterstruktur problems that often occur. Where the problem always recurs with an unclear settlement. So it requires an accurate decision by the leader or middle-level manager. With this decision support system will be given recommendations for middle managers/managers to be able to make decisions appropriately.

SMKN 2 Padang is one of the SMK N under the Education Office of West Sumatra Province. In 2015, the number of students SMK N 2 Padang as many as 1141 students, with the number of male students as many as 373 people, and women 818 people. Of the 1,191 students, as many as 583 students expressed less able. Along with the number of underprivileged students, then the distribution of scholarships by certain institutions or companies. The scholarships are classified as scholarship type of achievement and less capable types.

Registration of scholarship in SMKN 2 Padang still using manual way of filling sheets form by students obtained from student waka through their respective homeroom. Once the form is filled in, it is then returned to the homeroom to

be checked for the accuracy and completeness of the data. Then the list of students whose data has been completed will be forwarded to the administration to be selected based on predetermined criteria. After going through the selection process, it will get the data of the final scholarship recipient who the data will be submitted back to students affair for further processing.

Design of Decision Support Support System This scholarship produces a decision support system that can manage the selection process of scholarship in SMK N 2 Padang starting from registration to get some students who declared legitimate get scholarship.

Analytical Hierarchy Process (AHP) is a method for solving a complex, unstructured situation into several components in a hierarchical arrangement, giving subjective values of the relative importance of each criterion, and defining which criteria have the highest priority to influence the outcome of the situation the. Basically, the decision-making process is choosing an alternative. AHP's main tool is a hierarchy enabling the breaking down of complex or unstructured problems in sub-issues, then compiling them into a hierarchy.

In solving the problem with AHP there are several principles that must be understood, among them are:

1. Create a hierarchy

Complex systems can be understood by breaking them into supporting elements, hierarchically arranging elements, and combining them or synthesizing them.
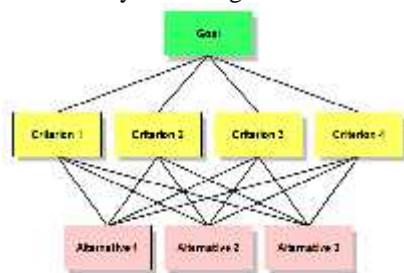

Figure 1. AHP Method Hierarchy

2. Criteria and alternative assessment

Criteria and alternatives are done by pairwise comparisons. According to Saaty (1988), for various issues, the scale 1 to 9 is the best scale for expressing opinions. The value and definition of the qualitative opinion of the comparison scale can be measured using the analysis table as shown in Table 1 below.

Table 1. Saaty's Comparison Scale

Scale $_{i,j}$	Information
1	Both criteria are equally important.
3	Criterion i is rather (weakly) more important than criterion j.
5	Criterion i is strongly (strongly) important from criterion j.
7	Criteria i is very (very strongly) important from criterion j.
9	Criterion I has an extreme interest (absolutely) from criterion j.
2, 4, 6, 8	Criteria i and j have a middle value between two adjacent decision values.
Reverse ($_{i,j}$ = 1/ $_{j,i}$)	Criterion i has more importance than criterion j, then criterion j has reversed value.

Based on these criteria values can be compiled a pairwise comparison matrix A as follows:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & \cdots & \cdots & a_{1,j} \\ a_{21} & a_{22} & a_{23} & \cdots & \cdots & \cdots & a_{2,j} \\ a_{31} & a_{32} & a_{33} & \cdots & \cdots & \cdots & a_{i,j} \\ \cdots & \cdots & \cdots & \cdots & \cdots & \cdots & \\ a_{11} & a_{12} & a_{13} & \cdots & \cdots & \cdots & a_{i,j} \end{bmatrix}$$

I, j represents the matrix element A of the thirteenth row of the column.

3. Synthesis of priority (determining priority)

For each criterion and alternative, a pairwise comparison (Pairwise Comparisons) is required. The relative comparative values of all alternative criteria can be adjusted to the predetermined judgment to generate weight and priority. Weights and priorities are calculated by manipulating the matrix or by solving the mathematical equations.

4. Logical Consistency (Logical Consistency)

Consistency has two meanings. First, similar objects can be grouped according to uniformity and relevance. Secondly, it concerns the level of inter-object relationships based on certain criteria.

5. DESIGN AND ANALYSIS SYSTEM
4.1 Analysis of AHP Method

The criteria considered in the selection of scholarship recipients in SMK N 2 Padang are:

1) The Scores of Progress Report (R)

It is a criterion that relates to the students' appraisal conducted within a certain period. In this case, the value of report cards used is the value of the last semester report card. The higher the value of the report cards of the scholarship recipients, the greater the opportunity to obtain scholarships.

2) Academic Achievement (PA)

It is a criterion related to student achievement of scholarship recipients, such as academic achievement that students achieve at school, city/provincial and national levels. The higher the level of academic achievement of the scholarship recipients, the more chance of getting a bigger scholarship.

3) Non-Academic Achievement (PNA)

It is a criterion related to academic achievement outside the academic that is extracurricular either at school, city/province, and national level. The higher the level of non-academic achievement of the scholarship recipients, the more chance of getting a bigger scholarship.

4) Parent's Earnings

Assessment criteria for this parent's income amount include the amount of salary received by the parents of the candidates receiving the scholarship for one month. The lower the income of parents of prospective scholarship recipients, the opportunity to get a scholarship is greater.

5) Number of Parent Dependents

Assessment of the criteria of the number of dependents of this parent includes the number of children owned by the parents of the prospective scholarship recipients. The more the number of dependents of parents, the greater the opportunity for scholarship recipients to get scholarships.
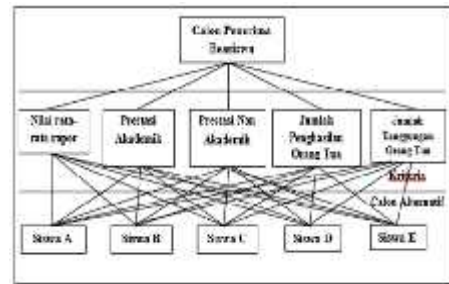

Figure 2. Structure of the Criteria Hierarchy

In figure 2 above, as for the objective of the decision support selection system, this scholarship is looking for the Scholarship Recipient Candidates. Criteria used are the Value Report, Academic Achievement, Non-Academic Achievement, Number of Parents and Total Parental Growth. While the alternative is the choice of scholarship applicants in SMK N 2 Padang.

Each alternative (prospective scholarship recipient) has different values and conditions for each criterion. hence it is necessary to convert the criterion value of the scholarship applicant's score to get a comparison of scoring scores among selected criteria.

1) The Scores of Progress Report (R)

Table 1. The Scores of Progress Report Value Parameters

Scores	Value
R > 80	SangatBaik
45< R <=80	Baik
70< R <=75	Cukup
R < = 70	Kurang

2) Academic Achievement

Table 2. Academic Achievement Parameter

Academic Achievement	Value
Nasional	SangatBaik
Provinsi / Kota	Baik
Sekolah	Cukup
Tidak Ada	Kurang

3) Non-Academic Achievement

Table 3. Non-Academic Achievement Parameter

Non-Academic Achievement	Value
Nasional	SangatBaik
Provinsi / Kota	Baik
Sekolah	Cukup
Tidak Ada	Kurang

4) Parent's Earnings

Table 4. Parent's Earnings Parameter

Parent's Earning (P)	Value
P < = Rp. 1.500.000,-	Kurang
Rp. 1.500.000 < P < = Rp. 2.000.000-	Cukup
Rp. 2.000.000 < P < = Rp. 2.500.000,-	Baik
P > = Rp. 2.500.000,-	Sangat baik

5) Number of Parent Dependents

Table 5. Number of Parent Dependents Parameter

Number of Parent Dependents (T)	Value
T >5	SangatBaik
T = 5	Baik
T = 4	Cukup
T < = 3	Kurang

After getting the priority then determined the comparison matrix

1) Determining the Matched Comparison Matrix Between Criteria (Level 0) For Award Type Scholarship

Table 6. Matched Comparison Matrix Between Criteria (Level 0) For Award Type Scholarship

Criteria	R	PA	PNA	P	T
R	1	3	3	4	5
PA	0.33	1	2	3	4
PNA	0.33	0.5	1	2	3
P	0.25	0.33	0.5	1	2
T	0.2	0.25	0.33	0.5	1
Jumlah	2.11	5.08	6.83	10.5	15

2) Determining the Matched Comparison Matrix Between Criteria (Level 0) For Less-Capable Scholarships

Table 7. Matched Comparison Matrix Between Criteria (Level 0) For Less-Capable Scholarships

Kriteria	P	T	R	PA	PNA
P	1	3	7	8	9
T	0.33	1	5	6	7
R	0.14	0.2	1	2	3
PA	0.13	0.17	0.5	1	2
PNA	0.11	0.14	0.33	0.5	1
Jumlah	1.71	4.51	13.83	17.5	22

After determining the comparison matrix between the criteria, the next step is to determine the matrix of criteria, the matrix of the comparison of each row, and calculate the consistency ratio of the criteria.

The next step is to determine the matrix of comparison between sub-criteria, the sub-criteria value matrix, the matrix of comparison of each sub-criterion line, and the sub-criteria consistency ratio in the same way. So for the final result is entered into a result matrix as below:

Table 7. Result Achievement Scholarship Matrix

R	PA	PNA	P	T
0.44	0.24	0.16	0.1	0.06
Sangat Baik	Sangat Baik	Sangat Baik	Sangat Baik	Sangat Baik
1	1	1	1	1
Baik	Baik	Baik	Baik	Baik
0.46	0.44	0.43	0.6	0.6
Cukup	Cukup	Cukup	Cukup	Cukup
0.2	0.28	0.26	0.36	0.34
Kurang	Kurang	Kurang	Kurang	Kurang
0.13	0.13	0.15	0.15	0.21

Table 8. Matrix of Underprivileged Scholarship Results

P	T	R	PA	PNA
0.52	0.29	0.09	0.06	0.04
Sangat Baik	Sangat Baik	Sangat Baik	Sangat Baik	Sangat Baik
1	1	1	1	1
Baik	Baik	Baik	Baik	Baik
0.6	0.6	0.46	0.44	0.43
Cukup	Cukup	Cukup	Cukup	Cukup
0.36	0.34	0.2	0.28	0.26
Kurang	Kurang	Kurang	Kurang	Kurang
0.15	0.21	0.13	0.13	0.15

To determine the point of the scholarship recipients, the method is to multiply the students' scores with priority criteria and priority sub criteria based on the student's score.

After calculating each student score, then the scholarship candidates with the highest point will be eligible for a scholarship.

4.1 System Design

System design is done to illustrate, and sketch or arrangement of some separate elements into a unified whole. This design is the result of the transformation of the analysis into the design that will be implemented.Context Diagram can describe in general the flow of data from within the system interact with each other. Context Diagram of the decision support selection system in SMK N 2 Padang scholarship is as in Figure 3.
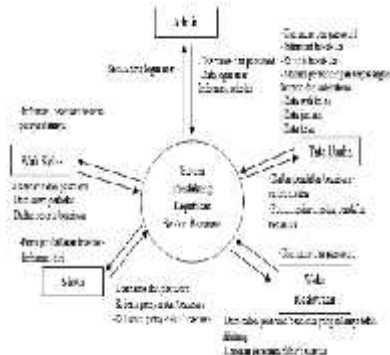
Figure 3. *Context Diagram*

Database design requires Entity Relational Diagram (ERD) to describe entities (actors) that play a role in a database and the relationship between actors who play the role. The following ERD of Decision Support Selection System Scholarship:
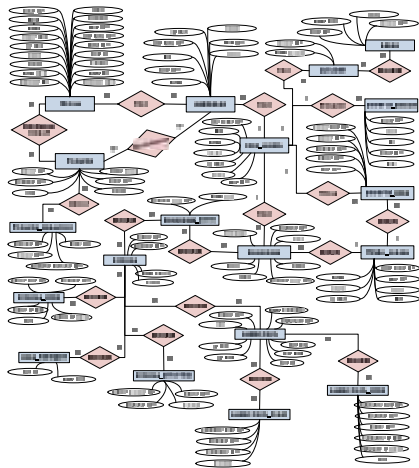

Figure 4. Entity Relational Diagram (ERD)

5. RESULT AND DISCUSSION

The implementation of the interface is to translate the layout that has been made on the interface design into the form of the system interface display intact. Login page is a page used as an intermediary to enter the system for schools that already have access rights

Figure 5. Login Page View

On the Login page shown in Figure 5, it contains the username and password fields that must be filled in order to enter the system and use the features provided by the system.

Administration is an actor in charge of adding scholarships, checking the completeness of the requirements of scholarship participants, and conducting scholarship selection. In addition, Administration also served in adding majors and classes as well as add user homeroom.

Page admin menu is a page that displays some menus that can be accessed by the administration, including the menu Scholarships, Matrices, Participants, Selection, Types of Scholarships, Guardian Class, Department and Class. These menus are the way to access other administrative pages. Here is a page view of the administration menu:
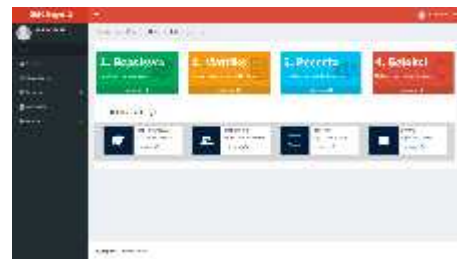

Figure 6. Page View Menu Administration

1) All Scholarships Page

All Scholarships Page are pages that are still on the scholarship menu. The page of all scholarships is used by the administration to see all the scholarships currently active. Here is an overview of all the scholarships:

Figure 7. Page Views All Scholarships

In Figure 7, we can see there are several buttons that will bring administration to a different page, such buttons include "Add Scholarship". Here is a page view that will appear when we select the button "Add Scholarship":

Figure 8. Page Views Add Scholarship

In addition to the "Add Scholarship" button there is also a button "Scholarship Walk" and "Scholarship Completed". The Button serves to showcase active scholarships and scholarships that have been completed / closed. Then still in picture 7, beside scholarship title there are some button, including Criteria button, Document, Edit and Delete. Button Criteria serves to add scholarship criteria. The appearance of the scholarship criteria page when the administration chose the Criteria button is as follows:

Figure 9. Scholarship PageViews

Figure 9 above shows the scholarship criteria page, to add the scholarship criterion simply by typing the criteria name in the criteria name field, then clicking the "Add" button, then the criteria will be added and will automatically be entered on the list of criteria that are in the column next to it.

After adding some scholarship criteria it will show some more buttons, namely button Parameter, Edit, and Delete. The following is a page view of the criterion of scholarship criteria when the administration chooses the button parameter:

Figure 10. Page View Add Parameter
Criteria

Back to the picture 7, in addition to the Criterion button there is another button that is the Document button. Here is the look of the scholarship document page if the administration chose the "Document" button:

Figure 11. Document Document
Scholarship View

Figure 11 is a page view of a scholarship document if the administration chooses a document button on one of the scholarships, in this case is Baznas Achievement Scholarship. To add the scholarship requirement document is by filling the form added document, then determine whether the document is mandatory or not.

2) Page Matrix Scholarship

Page Matrices The scholarship allows the administration to determine the matrix of pairwise comparison scholarship criteria (level 0). This matrix is the ratio of importance between a criterion and other criteria. Here is the pageview matrix comparison matched pair of scholarship criteria:

Figure 12. Page Views Matrix Comparison
Pair Criteria Scholarship (Level 0)

In Figure 12, after determining the degree of importance between criteria when the administration chooses the "SimpanKriteria" button, the matrix of pairwise pairs of criteria is stored. In addition to the "SimpanKriteria" button there are 2 other buttons. Among the "LihatMatriks" button, this button serves to see the matrix of criteria values, the matrix of the sum of each line, and the calculation of the consistency ratio. While the "View

Sub Criteria" button serves to view the sub criteria matrix. Here is a page view of the sub criteria matrix:

Figure 20. Page View Matrix Comparison Subcriteria (Level 1)

3) Student Scholarship Page

Page Participants Scholarship is a page that is used to check the data of scholarship participants. In this case the administration checks the criteria requirements data of the participants with supporting documents of the requirements. The page views of scholarship participants are as follows:

Figure 21. Participants' Pageviews

The purpose of checking the participant data is to avoid any fraud or data error before the selection process. If there are errors or less data, the administration can send messages directly to the students concerned. The message will appear when the students login to use their respective accounts.

4) Page Process Selection of Scholarship

The scholarship selection process page is the page used for the scholarship value calculation process. After all student data is checked by administration, then administration is entitled to start value calculation process. The look of the scholarship selection process page is as follows:

Figure 13. Page Views of the Scholarship Selection Process

Figure 13 is the result of calculating the value of scholarship participants, the values are obtained from the criteria values that have been entered by each student.

The value in the total column is the sum of all the values of each criterion. The value is derived from the student's score multiplied by the priority value of each subcriteria described in chapter III. Student data will be automatically sorted by the system from the highest value to the lowest value, the student with the highest score is eligible for a scholarship.

5) Page Add Class Guardian

The homepage page is a page used by the administration to register a homeroom user in order to gain access to the system. Here is a page view add homeroom class:

Figure 14. Page View Add Class Guard

6) Page Add School

Page added majors is a page that used administration to input data majors that exist in SMK N 2. Here is a page view added majors:

Figure 15. Page View Add Program

7) Page Add Class

Page added class is a page used by the administration to add the existing class in SMK N 2 Padang. Here is a class page view:

Figure 16. Class Add Page View

a) Page of Students Affair

Students Affair is an actor who has limited access rights, which is to see the result of calculating the value of the scholarship participants and print it in the form of report to be submitted to the scholarship dealer.

1) Scholarship Selection End Selection Page

The scholarship selection selection page is a page that allows students to determine the final recipient of the scholarship based on the calculation of the value performed by the previous administration. In this system, student affairs have a managerial position, so the final decision is in student affairs, not in value calculations because decision support systems are only used to support decisions, not substitute decision makers in making decisions. Here students will choose students who are eligible for a scholarship based on other considerations beyond the criteria used previously. Here is the final selection of scholarship recipients:

Figure 17. Final Beneficiary Selection Page Selection

b) Report of the Scholarship Recipient's Report

The report page of the recipient of the scholarship is a page that allows students to print the results of the calculation of the scholarship value of the scholarship recipient in the form of the scholarship report to be submitted to the scholarship dealer. The report page views are as follows:

Figure 18. Report of the Scholarship Recipient's Report

To print the report of the scholarship recipients, the students choose the submenu of the scholarship achievement, whereas if they want to print the report of the recipients of the underprivileged scholarship then the student chooses submenu of the underprivileged scholarship.

The appearance of reports of recipients that are ready to print are as follows:

Figure 19. Views of the Scholarship Recipient Report

6. **CONCLUSION**

The conclusions that can be drawn from the Development of Decision Support System Selection Scholarship Using Analytical Hierarchy Process Based WEB method is as follows:

a. With the use of Personal Home Page (PHP) programming language and Codeigniter Framework we can develop a decision support system such as scholarship selection selection system.

b. Using the Analytical Hierarchy Process (AHP) method can facilitate the selection process based on the sum of the weights of each criterion.

c. With this system can help Waka Student and Administration in conducting the process of selecting scholarship type of achievement, less able and so on in SMK N 2 Padang.

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