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MODEL OF THE DETERMINATION OF INTEREST PROGRAM OR DEPARTMENT OF NEW STUDENTS USING ANALITICAL HIERARCHY PROCESS (AHP) AND SIMPLE ADDICTIVE WEIGHTING (SAW):

A CASE STUDY OF SMK NEGERI 7 PANDEGLANG

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Abstract :

The difficulty of new students in determining interest program or Department due to his solid performances for new students not in decision making. Thus causing the process of KBM became distracted, slow decision making process (the existence of a reasonable doubt in determining the appropriate departments or expertise with talent or interest, students can be expelled from the school, and the existence of quota restrictions on programs or majors. Methods used Analytical Hierarchy Process (AHP) and the Simple Additive Weighting (SAW) with this application aims to facilitate students in determining interest program or Department at SMK Negeri 7 Pandeglang.

Keywords: Interest In, Decision-making System, Analytical Hierarchy Process, Simple Additive Weighting Method.

I. INTRODUCTION

1.1 Background

The selection of programs or majors of students in SMK is one very important factor and has a great impact to the future of students. This is due to the desire of the students to continue their study of high keperguruan back, working according your interests and abilities that have been owned. Thus, Vocational secondary school (SMK N) 7 Pandeglang has several programs including a light vehicle engineering, engineering machinery, computer network engineering, multimedia, agri-food crops and horticulture, and accounting. With these methods facilitate students in decision-making in determining the interest program or Department.

1.2 Problem Identification

The determination of the interest of the Department or program at SMK N 7 Pandeglang, during this new admission Committee using a quota system of classes in each department or program

expertise. So, make students not consistent in defining the program or Department, MBC became distracted, the decision-making process becomes slow, students can be expelled from the school (due to the doubt raises the students easily move expertise or the Department), and the existence of quota restrictions on programs or majors. Therefore, required a model or draft system in determining interest program or Department for new students who wish to continue in SMK Negeri 7 Pandeglang.

1.3 Limitation Problem

To focus this research, then authors takes the limitations problem as follows:
1) Build a model or draft system in determining interest program or Department for new students who wish to continue his studies at SMK N 7 Pandeglang.
2) The System is constructed by applying the Analitical Hierarchy Process (AHP) and the Simple Additive Weighting (SAW)
3) There are four research criteria that will be used to get the output of the system. As for the criteria used in determining interest program or Department students in SMK N 7 Pandeglang is as follows [KEMENDIKBUD Curriculum,2013]:
   a. the value of report cards
   b. the value of the interest
   c. average value of UN
   d. the value of Interviews

1.4 Formulation Of The Problem

Based on the identification of the problem the author formulates the problem that the difficulty of new students in determining interest program or Department.

1.5 Research Objectives

1) Are expected to provide ease for new students in determining interest program or Department
2) Expected method of AHP method and SAW can be used in determining the interest program or Department
3) To facilitate the process of KBM so effective.

II. THEORY

2.1 Interest

Interest based on the science of developmental psychology is a source of motivation that drives people to do what they want when they are free in choosing.

2.2 Decision Support System

Decision support system is a computer-based interactive system that helps the decision making utilizing the data and models to solve unstructured problems.

2.3 Analitical Hierarchy Process (AHP)

Alternative order methods to make decisions and choose the best one at the moment of decision makers has several objectives, or criteria for a particular decision. "that one factor more important than the absolute very other.
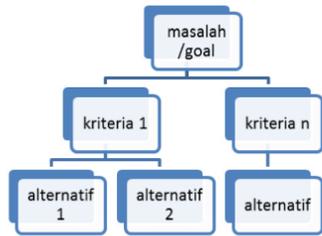

Fig. 2.1 Analitical Hierarchy Process

2.3.1 The steps in the method of Analytical Hierarchy Process (AHP), among other things:

1) Defining the problem and determine a solution into a hierarchical structure
2) in AHP decision makers determine the value or the "score" of each alternative for a criterion by using paired comparison (pairwise comparision)

Table 2.1 Scale Comparison AHP

Number Value	Level Of Preference
1	The same preferred
2	Until quite liked
3	Quite liked
4	Enough until the highly preferred
5	Highly preferred
6	Very well liked until the very, very likeable
7	Very, very well liked
8	Very, very well liked until outstanding preferred
9	outstanding preferred

3) Make alternative decisions in each of the priority criteria. In the stage of AHP is called synthesis (synthesization).
4) Calculating eigenvalues and test the consistency if not consistent then the data retrieval is repeated.

Table 2.2 The value of the RI for comparison of n items

Ordo Matriks	1	2	3	4	5
Ratio Index	0	0	0,58	0,9	1,12

5) Calculate vector of eigenvalues of any comparison matrix pairs. Eigen vector value is the weight of each element
6) Calculate the consistency of Analytical Hierarchy Process (AHP)

$$CI = \frac{\lambda\, maks - n}{n - 1}$$

Description :
CI = Consistency Ratio
$\lambda\, maks$ = The Value of the largest eigen values form a matrix n
n = The number of elements based on the source criteria.

$$CR = \frac{CI}{IR}$$

In General, the level of consistency is said to be satisfactory if the CI/RI ≤ 0.1. However, if the

CI/RI ≥ 0.1 then chances are there is a serious consistency and results of AHP may not be consistent.

2.4 Simple Additive Weighting (SAW)

The basic concept of a Simple Additive Weighting method is to find a weighted summation with performance rating on any alternative on all attributes. According to [Nofriansyah 2014], Simple Additive Weighting method is often known as the weighted sum method. Formula or formula for this normalization process is as follows:

$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{Max_i\, X_{ij}} & \text{If } j = benefit \\[2em] \dfrac{Min_i\, X_{ij}}{X_{ij}} & \text{If } j = cost \end{cases}$$

The value of the preference for each alternative (Vi) provided as follows:

$$V_i = \sum_{j=1}^{n} W_j\, R_{ij}$$

Description :
V_i : The rank for each alternative
W_J: Value Weighted rank (of each criteria)
R_{ij}:Ternormalisasi Performance Rating value
The values Vi larger alternative Ai indicated that more elected.

2.5 Technology Acceptance Model (TAM)

Model TAM comes from psychological theories to explain the behavior of users of information technology based on belief (belief), attitude (attitude), intention (intention) and the relationship of the user's behavior (user behavior relationship). This model a theory of person's behavior as a function of the goal behavior. The purpose of the behavior is determined by the attitude of the top such behaviour according to [Sarana 2000].
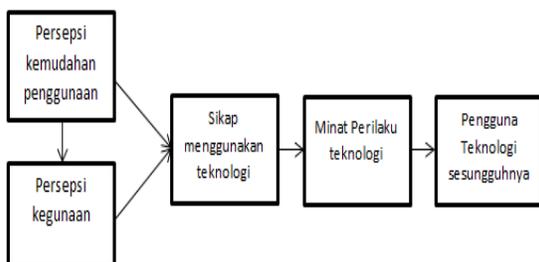

Fig. 2.2 Technology Acceptance Model (TAM)

III. METHODOLOGY AND RESEARCH DESIGN

3.1 Research Method

This Study uses descriptive method quantitative, is data obtained from the sample population research analyzed in accordance with statistical methods that are used through the weighting parameters by using the method of Analytical Hierarchy Process (AHP) and Simple Addictive Wighting (SAW) and to find the optimum alternative of alternative criteria are already determined.

3.2 Sampling / Sample Selection Method

The sampling techniques used in this research is a method of sampling purpose is deliberately sampling in accordance with defined aims so that the data obtained could be more representative. Data retrieval based on the original data from the source that is collected directly by survey in the field by disseminating a questionnaire to new students who have enrolled in SMK Negeri 7 Pandeglang. Samples taken as many as 30 people consisting of 5 Kajur, 1 Kepsek, 4 Admin and 20 students.

3.3 Engineering Design

In this research, the author uses the method of SDLC or system Development Life Cycle with a model of the waterfall by the stages of software needs analysis, software design, creation of program code, software testing and support or maintenance.

IV. RESULTS AND DISCUSSION

.1 Calculation by the method of Analytical Hierarchy Process (AHP)

.1.1 Data Preparation Methods

Below is the raw data table consists of four student parameter and can be seen in table 4.1

Table 4.1 Sub Criteria Data of students of JUNIOR HIGH SCHOOL or MTS

No.	Alternative	Raport Value	Interested Value	Average UN Values	Interview Value
1	Adini Nur Muhlis	95	80	88	75
2	Aiman Nurwahid	95	80	89	75
3	Alpiah	79	83	81	91
4	Alsa Ananda	82	80	81	75
5	Anisa Apripuspita	80	80	80	75
6	Dela Listiani	86	76	58	88
7	Diah Lismawati	90	85	45	92
8	Entu Masheni	82	85	45	90
9	Eva Rosmawati	85	78	39	87
10	Fazrina Nur Fadillah	87	79	33	80

.1.2 Paired Comparison Matrix

The first step is to do a comparison of pairs of each parameter. Paired comparison of the results obtained following the interview with the head of the school (Kepsek).

Table 4.2 Paired Comparison Matrix

Criteria	Raport	Interested Valued	Average OF UN Value	Interview Values
Raport Value	1,0	2,0	1,0	3,0
Interested Values	0,500	1,0	0,5	2,0
Average OF UN Valued	1,0	3,0	1,0	2,0
Interview Values	0,333	0,5	0,5	1,0

.1.3   Add up the values of each column of the paired comparison

Then, the result of paired comparison values in table 4.3 combined any columns so that obtained results are as follows:

Table 4.3 Summing Columns Paired Comparison

Criteria	Raport	Interested Valued	Average OF UN Value	Interview Values
Raport Value	1,0	2,0	1,0	3,0
Interested Values	0,500	1,0	0,5	2,0
Average OF UN Valued	1,0	3,0	1,0	2,0
Interview Values	0,333	0,5	0,5	1,0
Total	**2,8**	**6,5**	**3,0**	**8,0**

.1.4   Data Normalization

With the elements in each column is divided by the total amount in the corresponding column, will be obtained relative weights are normalized.

Table 4.4 Data Normalization Paired Comparison Matrix

Criteria	Raport	Interested Valued	Average OF UN Value	Interview Values
Raport Value	0,352941176	0,308	0,333	0,375
Interested Values	0,176470588	0,154	0,167	0,250
Average OF UN Valued	0,352941176	0,462	0,333	0,250
Interview Values	0,117647059	0,077	0,167	0,125

Calculation:
a)   For The Parameter Value Of The Raport (P_1) :

Raport Values $= \dfrac{1}{2.8} = 0.352$

Interested Value $= \dfrac{0.500}{2.8} = 0.1764$

Average UN Value $= \dfrac{1.0}{2.8} = 0.352$

Interview Value $= \dfrac{0.333}{2.8} = 0.1176$ etc..

.1.5   To Calculate The Weighting Of Criteria

The next step, namely to calculate the weighting of criteria (Eigen Vectors) generated from the average value of the relative weights for each line.

Table 4.5 The results of weighting criteria calculation based on normalization of the matrix

Criteria	Raport Value	Interested Value	Average UN Value	Interview Value	Eigen Vector
Raport Value	0,352941176	0,308	0,333	0,375	0,342
Interested Value	0,176470588	0,154	0,167	0,250	0,187
Average UN Value	0,352941176	0,462	0,333	0,250	0,349
Interview Value	0,117647059	0,077	0,167	0,125	0,122

Calculation:

a) $\dfrac{0.3529 + 0.462 - 0.333 + 0.250}{4} = 0.349$ etc.,

.1.6   Determine the Maximum λ

Eigen value next maximum (maximum λ) is obtained by summing the results of the multiplication of the number of columns with eigen vector.

Maximum λ :
= (2.8*0.342) + (6.5*0.187) + (3.0*0.349)+(8.0*0.122)

$= 0.9576 + 1.2155 + 1.047 + 0.976$

$= 4.2$

.1.7   Determine The Value Of CI

Calculate the value of the Consistency Index (CI) using the formula:

$$CI = \frac{\lambda \text{ maks} - n}{n - 1}$$

$$CI = \frac{4.2 - 4}{4 - 1}$$

$$CI = \frac{0.2}{3} = 0.0667$$

.1.8   Testing Of the Consistency Ratio

CR is obtained by dividing the CI and RI is the Ratio Index obtained from table Saaty, the values for the matrix RI comparison order conditioned 4 x 4 is 0.9 can be seen in table 4.6:

Table 4.6 Size Of Matrix

Ordo Matriks	1	2	3	4	5	6	7	8	9	10
Ratio Index	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,46	1,49

Calculation:

$$CR = \frac{CI}{RI}$$

$$CR = \frac{0.0667}{0.9} = 0.0741$$

Comparative assessment is said to be consistent if the CR is not more than 0.1 so that assessment criteria determination comparison program or Department for new students is already consistent and does not require a revision of the assessment.

.2   The calculation by the method of Simple Additive Weighting (SAW)

As for the troubleshooting steps in the determination of the interest of the Department or program for new students in SMK Negeri Pandeglang 7 as follows:

.2.1   Alternative Value Matrix

This assessment is completed by the head of the academic Department or every semester, the assessment Standards already set by the head of Department or the academic based on academic meetings.

Table 4.7 Alternative Value Matrix

Alternative	Criteria			
	C1	C2	C3	C4
A1	95	80	88	75
A2	95	60	88	75
A3	79	83	81	91
A4	82	80	81	75
A5	80	80	80	75

There are five Alternatives provided::

A1 = Accounting
A2 = TKJ
A3 = Multimedia
A4 = TKR
A5 = Agro Business

.2.2   The Value Of The Normalization Of The Individual Criteria

Before entering in the calculation of the normalization of the individual criteria, please note the formula will be used. Because, on the method of Simple Additive Weighting (SAW) there are two calculation options normalization.

Table 4.8 Classification Criteria

Classification Criteria		
Code	Criteria	Description
C1	Raport Value	benefit
C2	Interested Value	benefit
C3	Value Of Average UN	benefit
C4	Interview Value	benefit

.2.3   Calculation Of Normalization Based On Criteria

The following normalization calculation based on criteria in the determination of the interest of the Department or program for new students in SMK Negeri 7 Pandeglang.

Table 4.9 Value Of Normalization Matrix

Alternative	Normalization			
	C1	C2	C3	C4
A1	1	0.964	1	0.824
A2	1	0.723	1	0.824
A3	0.832	1	0.92	1
A4	0.863	0.964	0.92	0.824
A5	0.842	0.964	0.909	0.824
Weight	**0.342**	**0.187**	**0.349**	**0.122**

Calculation:

a) Find Value Normalization on the criteria C1 (Raport Value) Alternate with R1 = R2 = accounting, TKJ, R3 = Multimedia, R4 = TKR and R5 = agro business

$$R_1 = \frac{95}{max\ 95} = 1$$

$$R_2 = \frac{95}{max\ 95} = 1$$

$$R_3 = \frac{79}{max\ 95} - 0.832$$

$$R_4 = \frac{82}{max\ 95} = 0.63$$

$$R_5 = \frac{80}{max\ 95} = 0.842\ etc,.$$

.2.4   Multiplication with weights

After the R rating was obtained, the next step is to process the value of the preference for each alternative using the formula below:

$$V_i = \sum_{j=1}^{n} w_j \, r_{ij}$$

Where:

V_i = Rank for each Alternative

W_J = value of the weighting of each criterion

R_{ij} = value ternormalisasi Performance Rating

$A_{1=}$ (1.00*0.342) + (0.96*0.187) + (1.00*0.349) +

(0.82*0.122)

= **0.97** etc..

.2.5 Alternative Of Rank

Alternatives Rank in the summation of each column, and then sorted from largest to smallest value. Then it can be an alternative in the determination of program expertise or majors for students new A_1 on behalf of Adini Nur Muhlis.

Table 4.10 Alternative Rank

Alternative	Normalization				Total	Ranking
	C1	C2	C3	C4		
A1	1	0,964	1	0,824	0.97	1
A2	1	0,723	1	0,824	0.93	2
A3	0,832	1	0,92	1	0.91	3
A4	0,863	0,964	0,92	0,824	0.90	4
A5	0,842	0,964	0,909	0,824	0.89	5
Weight	0.342	0.187	0.349	0.122		

.3 Flowchart Algorithms Of Calculation Method AHP

The main function of this flowchart is to describe a program design to represent the system we will create. Here is a flowchart illustrating the algorithm to calculation method using AHP already outlined above.
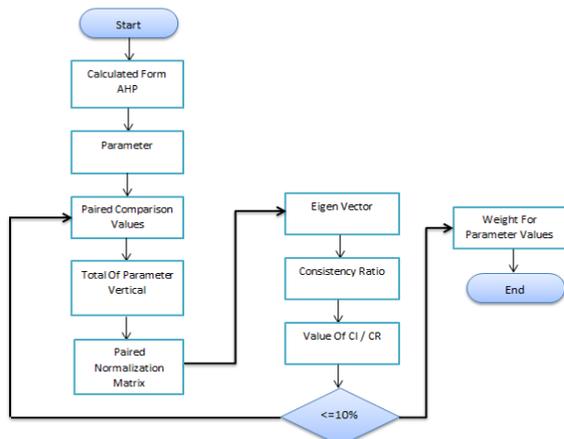
Fig. 4.1 Flowchart Algorithms Of Method AHP

.4 Flowchart Algorithms Of Calculation Method SAW

Here is a flowchart illustrating the algorithm for calculation using the method outlined above already Simple Additive Weighting (SAW).
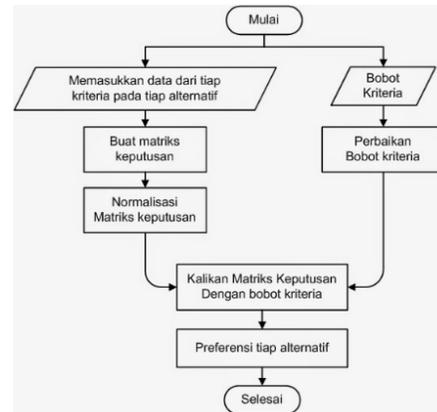

Fig. 4.2 Flowchart Algorithms Of Method *Simple Additive Weighting* (SAW)

.5 User Interface

A. Login Page
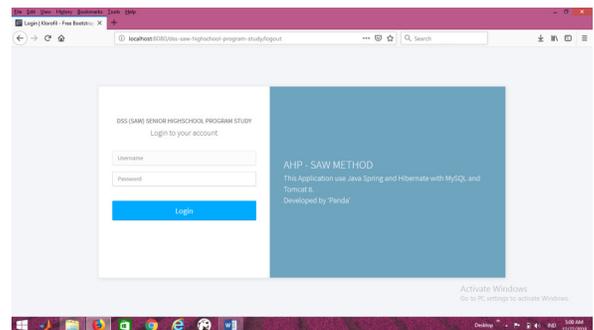
B. Home Page
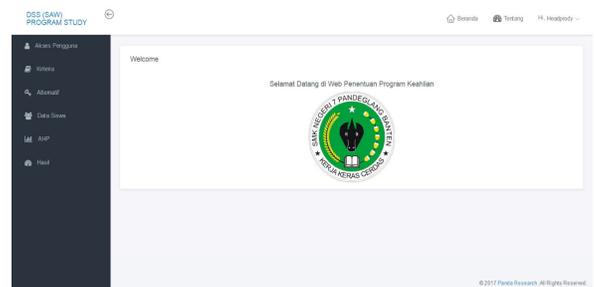
C. Criteria Page
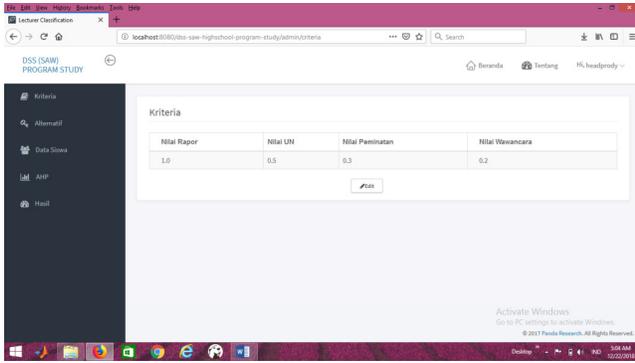
### D. Alternative Page
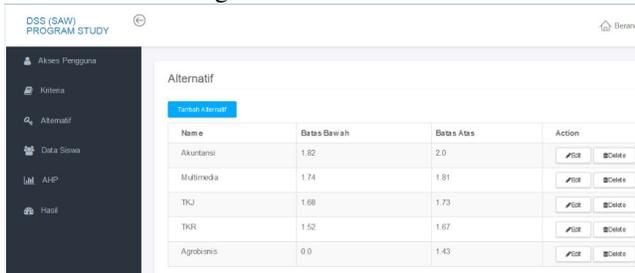
E. Consistency Page

F. Result Page

V. CONCLUTIONS

.1 Based on the issue, the study of literature, research review, research and Review of research object methodology in determining interest or skills program for new students by using AHP algorithm and SAW, can be summarized as follows:

1. This research was conducted at SMK Negeri 7 Pandeglang in particular on the part of Kepsek, the head of the Department and the Admin, as for problems that examined is the difficulty in determining a student's program or Department.
2. Research objectives to be achieved is to give input to the Kepsek, head of Department, Admindalam determine the program or Department for new students and make it easier for new students in determining the appropriate Department or program.
3. The methods used in this research is a method of Analitycal Hierarchy Process (AHP) and the Simple Additive Weighting (SAW), as for the method of AHP to calculate the weighting of each of the parameters while looking for the optimum alternative of SAW alternate with specific criteria.
4. From the above case obtained that value or the smallest parameter range is intended for Department of Agribusiness and for the largest range of parameters intended for accounting.

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