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Determining The Selection Of Departments At Abdi Negara Vocational School Using The Additive Ratio Assessment (Aras) Method

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Abstract

Along with the occurrence of competition and the development of technology and information in the current era of globalization requires skilled and ready-to-use human resources in the world of work. The efforts made are to improve the quality of education in Indonesia which always receives attention from various parties. One way to improve education is to determine the right majors at Vocational High Schools (SMK). The differences in each student with a different background must be considered because they can determine whether student achievement is good or bad. In ddition, the decision also greatly influences the alternative process chosen, especially in choosing the concentration of majors that are in accordance with the skills and expertise of students. Based on the author's observations at ABDI NEGARA VOCATIONAL SCHOOL through data collection both by conducting interviews and through available documents, the reasons students choose majors are usually based on student parents' references, besides that due to trend reasons (most students take that major). Therefore, through research using Decision Support Systems, it is hoped that it can provide recommendations to find out which majors to choose according to the interests or abilities of each student. So that there are no problems regarding failure or dropping out of school (drop out).

***Keywords**: Decision support system, Department, ARAS.*

1. Introduction

Along with the occurrence of competition and the development of technology and information in the current era of globalization requires skilled and ready-to-use human resources in the world of work. The efforts made are to improve the quality of education in Indonesia which always receives attention from various parties. Therefore, everyone must be able to equip themselves with skills and expertise in their respective fields so that they can be responsible according to their field of work. One way to improve education is to determine the right majors at Vocational High Schools (SMK). The differences in each student with a different background must be considered because they can determine whether student achievement is good or bad. In addition, the decision also greatly influences the alternative process chosen, especially in choosing the concentration of majors that are in accordance with the skills and expertise of students.

Based on the author's observations at ABDI NEGARA VOCATIONAL SCHOOL through data collection both by conducting interviews and through available documents, the reasons students choose majors are usually based on student parents' references, besides that due to trend reasons (most students take that major). Therefore, through research using Decision Support Systems, it is hoped that it can provide recommendations to find out which majors to choose according to the interests or abilities of each student. So that there are no problems with failure or dropping out of school. One of them is SMK ABDI NEGARA which has several majors including Computer Network Engineering (TKJ), Motorcycle Engineering (TSM), Light Vehicle Engineering (TKR), Office Administration (AP), and Building Drawing Engineering (TGB). By applying majors through filling out registration forms for new students, as well as determining what majors to take, it is still done manually. The selection of each major is based on the student's choice when registering through the registration form by determining their respective interests.

2. Research Methods

2.1 Decision support systems

According to book sources by Basuki et.al, 2016 [1], Decision Support Systems (DSS) or Decision Support Systems (DSS) are interactive computer-based systems that assist decision makers in using data and models to solve unstructured problems. This support system assists management decision-making by combining complex data, models and analysis tools as well as user-friendly software into a powerful system that can support semi- or unstructured decision-making [2].

2.2 The ARAS method

Based on the source [3] there is a study to solve the problem, namely by calculating the Additive Ratio Assessment (ARAS) method. The Additive Ratio Assessment (ARAS) method is a decision-making method based on the concept of ranking each criterion for each alternative, where the alternative must have the largest ratio to produce the optimal solution [4], [5].

2.3 The steps of the ARAS method

As for the completion steps in the Additive Ratio Assessment (ARAS) method, it can be made using the equation as follows:

1. Formation of a Decision Making Matrix

$$\mathbf{X} = \begin{bmatrix} \mathrm{X01} & \mathrm{Xoj} & Xon \\ \mathrm{X11} & \mathrm{Xij} & Xin \\ \mathrm{Xn1} & \mathrm{Xmj} & Xmn \end{bmatrix} \quad (1)$$

Definition 2.1:
Where:
m = number of alternatives
n = number of criteria
x = decision matrix
X_{ij} = value of alternative i to criterion j
X_{oj} = optimum value of criterion j

If the criterion value (X_{oj}) is not known, it can be solved by equation, which is as follows:
The optimum value (X_{oj}) of the criteria is divided into (2):

- If Benefit criteria then $X_{oj} = \frac{\max}{1}$
- If the criteria are Cost/cost then $X_{oj} = \frac{\min}{1}$

Where :
X_{ij} = value of alternative i to criterion j
X_{oj} = optimum value of criterion j
Max= optimal value of criteria and matrix

2. Normalization of the decision matrix for all criteria
If the Benefit criterion is (max) then normalization is carried out with the equation as follows:

$$X_{ij*} = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}} \quad (2)$$

Definition 2.2:
Where :
X_{ij*} = normalized value
If the criteria are Cost (min) then normalization is carried out with the equation as follows:

$$X_{ij*} = \frac{1}{x_{ij}}; R = \frac{x_{ij}}{\sum_{i=0}^{m} x_{ij}} \quad (3)$$

Definition 2.3:
Where :
X_{ij} = normalized value
R = normalized matrix

3. Determine the matrix weight that has been normalized with the equation as follows:

$$D = [d_{ij}]m_{Xn} = r_{Xn}.W_{Xn} \quad (4)$$

Definition 2.4:
Where :
D = Weighted normalized matrix
R_{ij} = Normalized value
W_j = Weight

4. Menentukan nilai fungsi optimalisasi (S_i) dengan persamaan yakni sebagai berikut :

$$S_i = \sum = n\ j \quad (i = 1, 2, \ldots\ldots m : j = 1, 2, \ldots\ldots n) \tag{5}$$

Definition 2.5:
Where :
S_i = optimum function value of the alternative
$\sum$ = sigma (sum)
The biggest value is the best value, the smallest/few is the worst value. By taking into account the proportional relationship process with the value and weight of the criteria that are known to affect the final result.

5. Determine the highest ranking of the alternatives with the following equation:

$$K_i = \frac{S_i}{S_o} \tag{6}$$

Definition 2.6:
Where :
S_i = optimum function value of the alternative
S_o = optimum criterion value
K_i = utility value

3. Results And Discussion

3.1. Research Methodology

In conducting research on this thesis, the researcher carried out the stages in the research methodology, namely as follows:

1. Problem Identification
   This stage is the initial stage used to identify problems with the aim of observing and looking for problems being faced at ABDI NEGARA VOCATIONAL SCHOOL, namely through data collection by conducting interviews or collecting the necessary data/documents.
2. Gathering Supporting Theory
   Collection of theories related to the subject matter such as the theory of Decision Support Systems (DSS), the methods used and the design applications of the required systems. In this stage, theory is collected from several sources such as books, journals, articles, and other references.
3. Testing Methods
   At this stage the researcher will test the methods used in the decision support process to determine the selection of the right majors in SMK with guidelines that are in accordance with supporting theories from books and journals related to the problem.
4. System Design
   At this stage a system design is carried out for the problem being studied, which can be in the form of a stage for designing the workflow of the system and also designing the design of the interface of the system to be created.
5. Method Implementation
   Implement the methods that have been previously tested with the system design that has been made and do the coding according to the programming language used to make the system.
6. Program Testing
   In the final stage, a series of tests are carried out on the program that has been made, tests are carried out in order to find deficiencies and weaknesses in the system, which are then reviewed and repaired to the application so that it becomes better and more perfect.

3.2. System Analysis

System analysis carried out is to determine the process that must be done to solve existing problems. After the analysis phase is carried out, the result will be that the system analysis has been running on the right track.
The system built utilizes a decision support system in determining the final results and decisions in determining the selection of majors because the decision support system can adapt problems to the existing criteria.

3.3. Process Design

The process of determining the selection of majors at ABDI NEGARA VOCATIONAL SCHOOL by using the ARAS method can be seen in the following flowchart design image:

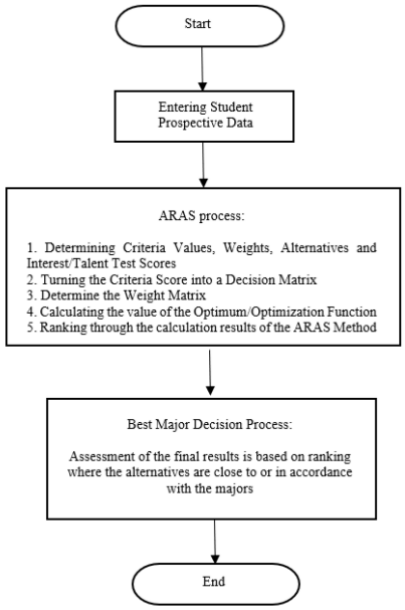

Fig.1: Flow of the Stages of Determining Major Selection Using the ARAS Method

Use Case Diagram is a model used in software engineering that shows a set of use cases and actors/administration as well as the relationship between the two.

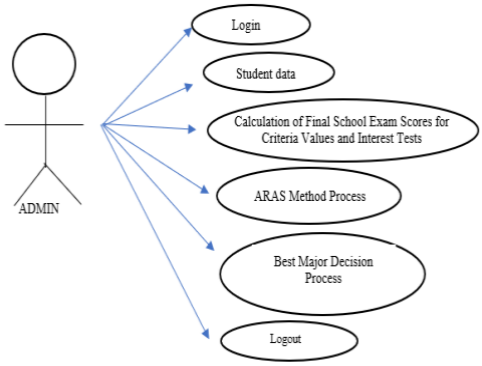

Fig.2: Use Case

Information:
The use case above explains the rights possessed by the user. Admin must login first to validate himself as an admin in this system. Admin enters student data and manages criteria and alternative data. Then the Admin will carry out the calculation process with the ARAS Method and in the final stage the Admin can see the results of the calculations in the system.

3.4. Determining Criteria Weight

The following is the weight of the criteria used in selecting majors at SMK, namely using a value of 1 to 100, and it is known that the criteria used are the Junior High School Level Test Scores (SCHOOL EXAMS SMP/ US SMP) Subjects in Indonesian Language, Science, English, Mathematics, and Interest/Aptitude Test which will later be calculated and processed.

The following criteria are used with the following values:

Table 1: Criteria Weight Value

NO	CRITERIA	MARK	WEIGHT (WJ)
1	SCHOOL TEST SCORES INDONESIAN		
	95,00 – 100,00	100	15%
	90,00 – 94,99	90	
	85,00 – 89,99	85	
	80,00 – 84,99	80	
	75,00 – 79,99	75	
	70,00 – 74,99	70	
2	SCHOOL TEST SCORES SCIENCE		
	95,00 – 100,00	100	20%
	90,00 – 94,99	90	
	85,00 – 89,99	85	
	80,00 – 84,99	80	
	75,00 – 79,99	75	
	70,00 – 74,99	70	
3	SCHOOL TEST SCORES ENGLISH		
	95,00 – 100,00	100	15%
	90,00 – 94,99	90	
	85,00 – 89,99	85	
	80,00 – 84,99	80	
	75,00 – 79,99	75	
	70,00 – 74,99	70	
4	SCHOOL TEST SCORES MATHEMATIC		
	95,00 – 100,00	100	20%
	90,00 – 94,99	90	
	85,00 – 89,99	85	
	80,00 – 84,99	80	
	75,00 – 79,99	75	
	70,00 – 74,99	70	
5	INTEREST/TALENT TEST		
	Computer Network Engineering	100	30%
	Technical Light Vehicle	90	
	Office Administration	85	
	Motorcycle Engineering	75	
	Building Drawing Techniques	70	

3.5. Determining Criteria Weight Normalization

Calculating the normalized weight (wj) in the manual calculation of the ARAS method based on the normalization formula above, then the weight value (wj) of each criterion is divided by the total number of criteria weights, the following results will be obtained:

Table 2: Criteria Weight Normalization

No.	Criteria	WEIGHT (Wj)	Normalization Wj/(∑_wj)
1	Indonesian	15%	15/100=0,15
2	Science	20%	20/100=0,2
3	English	15%	15/100=0,15
4	Mathmatic	20%	20/100=0,2
5	Interest/Talent Test	30%	30/100=0,3
Jumlah		**100%**	**1**

3.6. Alternative Data Transformation

The transformation of student data in 2022 can be seen in:

Table 3: Student Data Table

No	Student Code	C1	C2	C3	C4	C5
1	A1	90	90	85	100	85
2	A2	90	100	90	100	85
3	A3	80	80	80	80	100
4	A4	90	85	80	80	85
5	A5	85	85	80	85	100
6	A6	85	85	80	85	100
7	A7	80	80	80	80	75
8	A8	85	90	85	85	85

9	A9	80	80	85	80	100
10	A10	75	80	75	80	90
11	A11	80	80	80	80	75
12	A12	75	80	75	75	75
13	A13	85	80	80	80	85
14	A14	75	75	70	75	70
15	A15	85	85	85	80	85

After being weighted, the calculation is carried out using the ARAS method as follows:
Formation of Decision Making Matrix Decision can be seen in table 4.

Table 4: Decision can be seen in table

No	Student Code	C1	C2	C3	C4	C5
1	A0	90	100	90	100	100
2	A1	90	90	85	100	85
3	A2	90	100	90	100	85
4	A3	80	80	80	80	100
5	A4	90	85	80	80	85
6	A5	85	85	80	85	100
7	A6	85	85	80	85	100
8	A7	80	80	80	80	75
9	A8	85	90	85	85	85
10	A9	80	80	85	80	100
11	A10	75	80	75	80	90
12	A11	80	80	80	80	75
13	A12	75	80	75	75	75
14	A13	85	80	80	80	85
15	A14	75	75	70	75	70
16	A15	85	85	85	80	85
Criteria Max		**1330**	**1355**	**1300**	**1345**	**1395**

Next, the ranking will be determined based on the highest student rank:

Table 5: Student rank

No.	Name	Final Score	Rank
1	Keysha Indriyani	0,95	1
2	Risca Amelia	0,92	2
3	Vela Siska	0,92	3
4	Yesika Auliya	0,92	4
5	Pitri Rahmadhani	0,89	5
6	Adellia Putri	0,89	6
7	Icha Kumala Dewi	0,88	7
8	Indira Julia Wardani	0,87	8
9	Shinta Firanata	0,86	9
10	Herlina	0,85	10
11	Alfan Fauzul Rizki	0,84	11
12	Imam Syahputra	0,81	12
13	Ridwan Fatur Rahman	0,81	13
14	M. Maulana	0,79	14
15	Muhammad Iqbal	0,76	15

Alternative Tables for Determining Majors :

Table 6: Determining Majors

Mark	Information
0,95 – 1,00	Computer Network Engineering
0,89 – 0,94	Technical Light Vehicle
0,84 – 0,88	Office Administration
0,77 – 0,83	Motorcycle Engineering
0,70 – 0,76	Building Drawing Techniques

Based on the ranking results of the ARAS Method, a recommendation will be given to the Department of Computer Network Engineering with the highest score named Keysha Indriyani who gets a score of 0.95, while students who are given a recommendation for the Department of Light Vehicle Engineering with a score of 0.92 are Risca Amelia, Vela Siska, Yesika Auliya, and also Pitri Rahmadhani and Adellia Putri with a score of 0.89. In addition, the student who was able to enter the Department of Office Administration with the highest score was a student with a score of 0.88 named Icha Kumala Dewi, followed by Indira Julia Wardani with a score of 0.87, then Shinta Firanata with a score of 0.86, and Herlina with a value of 0.85, also Alfan Fauzul Rizki with a value of 0.84. Furthermore, students who are in accordance with the recommendations for the Department of Motorcycle Engineering are Imam Syahputra with a value of 0.81, Ridwan Fatur Rahman who is also

with a value of 0.81 and M.Maulana with a value of 0.79. The last recommendation for the Department of Building Drawing Engineering with an appropriate value of 0.76 is named Muhammad Iqbal.

4. Conclusions

Based on the description of the analysis and research regarding determining the selection of majors at SMK Abdi Negara using the Additive Ratio Assessment (ARAS) method, the authors draw the following conclusions:

1. Through the determination and selection of the right majors/in accordance with the abilities and skills of students can improve the quality of students in the future so that they are ready to enter the world of work.
2. The exact criteria in the ARAS method regarding determining majors at SMK are based on the results of the Middle School Level Examination Scores with subjects Indonesian, Science, English, Mathematics, Interest/Talent Tests made by the school.
3. The results of testing the ARAS method in determining majors at SMK are through the results of ranking students by the number of scores obtained. Then recommendations will be given based on alternative student majors which include Computer Network Engineering (TKJ), Motorcycle Engineering (TSM), Light Vehicle Engineering (TKR), Office Administration (AP), and Building Drawing Engineering (TGB).

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