

Decision Support System for selecting study programs using the AHP method

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Abstract: In accordance with the curriculum that applies throughout Indonesia, prospective MA students who will register for a school will experience major selection. For this reason, prospective students are expected to be able to assess their interests, talents, and abilities so that they do not choose the wrong major to take. Many prospective students choose majors because of the influence of friends. The role of parents is very important. Parents should be able to direct their children to choose majors according to their interests, talents, and career opportunities. choosing a major while in MA will have an effect on continuing to the next college or career. Majors available include, IPA and IPS. Majors will be adjusted to the abilities, talents and interests of students. The formulation of the problem in the writing of this scientific paper is limited to the scope where many prospective students want to go there but do not know what major is suitable for them. The purpose of this study is to assist students in choosing major that is suitable for those who are only recommendations using the analytical hierarchy process method. The results of this study were found that the interest criteria had 0.42% or in percentage described 42%, a talent had 0.95% or in percentage described 95% and career opportunities had 0.47% or in achievement 47% in choosing majors

Keywords: AHP, Decision, Choosing a Study Program, students, majors

INTRODUCTION

Decision-making is a major part of the activities of executive managers, employees, students, and every community in their lives. Common things that happen in decision-making are lack of information, self-confidence, not being able to describe existing problems, and many others. But in making decisions to choose the field of study.

Decision-making in determining a career is one of the developmental tasks that must be fulfilled by adolescents. Decision-making to determine students' majors at school is one part of determining future careers. (Sahputri, 2020) Suggests that the decision to choose a career has a positive relationship with the achievement of self-identity. A career is also seen as a determinant of social class in society. The community will give high honors and status to individuals who have positions or positions.

Education plays a very important contribution, especially if it is combined with efforts to develop the quality of human resources (HR). Because human dignity itself can only be increased with quality human resources.

High school as one of the important elements in this era of globalization is responsible for efforts to shape the life of the country and has very diplomatic responsibilities and duties in overcoming various educational problems, especially the quality of human resources.

Many public or private Schools offer a large number of courses. Sharing the possibilities and benefits of many individual study programs in Public or Private schools add value to student candidates. On the other hand, with the many courses offered, prospective students will have many options to choose their study program, but it is not uncommon for student candidates to be confused in determining options according to their interests and abilities.

However, there are also study programs that are less desirable, the number is because there are things that students take into consideration in choosing a study program at school.

(Purwanto, 2019) There are several types of AHP structures in this study consisting of:

1. Criteria containing all subjects of the national examination exam for junior high school, vocational junior high school, or junior high school level.

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2. The main alternative consists of 38 main problems.

In the next step, the user must assess several alternatives from the sub-field of study according to several views on the criteria that must be selected. Criteria can be divided into :

1. Criteria that focus on the internal and external aspects of new applicants and careers.
2. Sub-criteria consist of the need for reliable graduates or prospective students, interests, talents, majors of origin, teachers, tuition, scholarships, student capacity, campus popularity, quality and quantity of teachers, school location, availability of alumni forums, job vacancies/facilitation career, parental decisions, networking with industry, the influence of classmates, accreditation of study programs, learning facilities (location, hotspot area, library, classroom facilities (AC, LCD, computer), SW and HW lab, sports field pockets, mosque, and contents career).
3. Alternatives containing decisions of sub-fields of study.

The method chosen is the Analytical Hierarchical Process (AHP), because this method has a reference to support a decision where there are several components, one of the main ones is a functional hierarchy with the input being a human reason.

LITERATURE REVIEW

The concept that will be the basis of the system, which is recommended to make it easier for prospective students in choosing a study program using the Analytical Hierarchy process method, will be put forward as follows:

Definition of Decision

Decision (Decision) means choice (Choice). The choice referred to here is a choice of two or more possibilities, or it can also be said that it is a decision made after thinking by choosing possible alternatives. A decision is a definite answer to a question. Decisions must be able to provide answers to questions about what is discussed concerning planning (Sahputri, 2020).

Meaning of decision making.

Decision-making is part of the problem-solving process. In the problem-solving process, decision-making is one of the stages that can be said to be a milestone or a crucial point that must be passed. Because we know to get a very good decision is not a young thing, all humans can do it, But no one can guarantee the result. Giving a good decision will give a good result in an organization. While giving a bad result decision will have a bad impact on an organization (Sahputri, 2020).

RESEARCH STAGES

The decision-making steps that can be taken by educational institutions are as follows:

Intelligentie (intelegensi), i.e. investigating the environment for decision-making conditions, raw data are obtained, processed, and controlled for performance that can identify problems.;

Ontwerpen (Rancangan), namely finding, developing, and analyzing possible activities. This includes the process of understanding the problem, generating solutions, and testing solutions to determine whether they may or may not be implemented.

Choise (pilihan), that is choosing a particular method of activity from the methods that have been obtained, a choice is taken and implemented.

Implementatie (implemnetasi), namely the implementation of actions after obtaining a choice of various alternative activities that have been determined (Purwanto, 2019).

Decision support system

The concept of a decision support system was first introduced in the early 1970s by Michael S. Scott Morton with the term Management Decision System (Sprague Jr and Carlson, 1982). The concept of decision support is characterized by a computer-based interactive system that helps in decision-making utilizing data and models to solve unstructured problems. (Mesran et al., 2018), DSS is designed to support all stages of decision-making, starting from identifying problems, and selecting relevant data. Determine the approach used in the decision-making process, to evaluate choices (Tonni Limbong, Muttaqin Muttaqin, Akbar Iskandar, Agus Perdana Windarto, Janner Simarmata, Mesran Mesran, Oris Krianto Sulaiman, Dodi Siregar, Dicky Nofriansyah, Darmawan Napitupulu, 2020, bk. 113). A decision support system is a system intended to support managerial decision makers in semi-structured decision situations (Septilia & Styawati, 2020).

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AHP (analytical hierarchy process)

AHP was developed by Dr. Thomas I Saaty from the Wrthoon School of Business in the 1970s to organize information and make judgments in choosing the most preferred alternative. (Adha R. & Rasyid Ridha, 2021) Basically, AHP is a method for solving a complex and unstructured problem into groups, organizing these groups into a hierarchical arrangement, entering numeric values as a substitute for human perception in doing relative comparisons, and finally, a synthesis of the element that has the highest priority is determined. The advantages of AHP compared to others are:

1. A hierarchical structure, as a consequence of the selected criteria, to the deepest sub-criteria.
2. Taking into account the validity up to the tolerance limit for the inconsistency of various criteria and alternatives chosen by decision-makers
3. Taking into account the durability or resilience of the output sensitivity analysis of decision-making.(Jadriaman Parhusip, 2019)

There are four basic principles of AHP :

1. Determine Element Priority.
 - a. The first step in determining the priority of elements is to make a paired comparison, which is to compare elements in pairs according to the given criteria.
 - b. The pairwise comparison matrix is filled in using numbers to represent the relative importance of an element to other elements(Irawan et al., 2019).

C	A ₁	A ₂	A ₃	A _{..}	A _n
A ₁	A _{1,1}	A _{1,2}	A _{1,3}	A _{..}	A _{n,n}
A ₂	A _{2,1}	A _{2,2}	A _{2,3}	A _{..}	A _{n,n}
A ₃	A _{3,1}	A _{3,2}	A _{3,3}	A _{..}	A _{n,n}
A _{..}	A _n	A _n	A _{..}	A _{..}	A _{..}
A _n	A _{n,1}	A _{n,2}	A _{n,3}	A _{..}	A _{n,n}

Assessment of criteria and alternatives can be done by pairwise comparison. For various problems, a scale of 1 to 9 is the best scale for expressing opinions (Irawan et al., 2019).

The value and definition of qualitative opinion from a comparative scale can be seen in the table below (Irawan et al., 2019) :

Intensity interest	Information
1	Both elements are equally important
3	One element is slightly more important than the other
5	One element is more important than the other
7	One element is more absolutely important than the other elements
9	One element is absolutely important than the other elements
2,4,6,7	Values between two values of adjacent considerations
opposite	If activity i get one point compared to activity j, then j has the opposite value compared to i

METHOD

The stages of the research methodology are explained as follows:

Formulation Problem

At this stage, we identify a problem that exists in the selection of school majors for prospective students and summarize the problem according to the definition of its scope.

Formulation of Research Objectives

To determine the target to be achieved from the problems that exist in the research. The target of this research is the selection of school majors using the Analytical Hierarchy Process (AHP) method.

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Problem Identification

The introduction of this problem is carried out with the target of solving the causes of problems and examining the problems that occur with the selection of school majors for students

Studi Literatur

Literature sources come from books, journals and previous studies from books, journals, and previous studies. The criteria and weights in the study are as follows:

a. Researcher Interest

using interest as one of the criteria, to find out whether the interesting hypothesis has an influence on prospective students' decision-making in choosing the major.

b. Course Quality

The study uses the quality of the department as one of the criteria, to find out whether the hypothesis of the quality of the department has an influence on the decision making of prospective students in choosing the major, while for the alternatives, namely marketing and computer network engineering.

c. Career Opportunities

Researchers use career opportunities as one of the criteria, to find out whether the career opportunity hypothesis has an influence on prospective students' decision-making in choosing majors.

Primary Data Collection

For primary data collection based on questionnaire data that has been filled in by the respondents. Give the weight of the assessment based on the data of each respondent according to the criteria that have been determined.

1. Research data management consists of giving variable codes. Management using the Analytical Hierarchy Process method
2. Description of Research Results
Analyzing the results of data processing based on existing theories using the AHP barrier to obtain research results.

RESULT

Main criteria

Paired matrices for the main criteria of questionnaire data processing then produce the following table: Average value In the result of this division is the maximum principal eigen value (λ_{max}). $\lambda_{max} = 2,768$.

Consistency index value (CI) obtained:

$$CI = \frac{(\lambda_{max} - n)}{(N^3 - N)} = \frac{(2768 - 3)}{(3 - 1)} = -0.116091232$$

For = 3R = 0,58 MAKA :

$$CR = \frac{CI}{RI} = \frac{-0.116091232}{0,58} = 0,2001$$

Because $CR < 0.100$ means that the respondent's preference is consistent, the results of the calculations in the table above show that talent is the most important for recommendation for choosing majors for prospective students.

with a talent weight value with a total of 0.95 or in percentages described as follows 95% followed by career opportunities with a weight of 0.47 or can be described by 47% and followed by interests with a weight of 0.42% or described in a percentage of 42% from here we can see that the talent criteria are more dominant in determining the majors that will be chosen by prospective students. This is the main criterion that is calculated in the calculation, therefore the author also performs calculations with other criteria..

Talent criteria

In the talent criteria, there are sub-categories, yes, to produce output in the form of compatibility in the selection of majors, a sub-category is made, namely the majors in the school with the parameter being which subjects are more suitable for that department. Which is where the input results are obtained from the opinions of several teachers who work in that place.

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	IPA	MTK	BAHASA INDONESIA	IPS
IPA	1	1.4	2.333333333	7
MTK	0.714285714	1	1.666666667	5
Bahasa indonesia	0.428571429	0.6	1	3
IPS	0.142857143	0.2	0.333333333	1
TOTAL	2.285714286	3.2	5.333333333	16

The parameters for the science majors are obtained as follows. With the elements in each column divided by the number of columns in question, a normalized relative weight will be obtained. The eigenvector values are generated from the average relative weights for each row. The results can be obtained in the following table:

Normalisasi				
	IPA	MTK	Bahasa indo	ips
IPA	0.4375	0.4375	0.4375	0.4375
MTK	0.3125	0.3125	0.3125	0.3125
bahasa indo	0.1875	0.1875	0.1875	0.1875
ips	0.0625	0.0625	0.0625	0.0625
total	1.000	1.000	1.000	1.000

jumlah	prioritas	eigen vektor	lamda
1.75	0.4375	1	4
1.25	0.3125	1	
0.75	0.1875	1	
0.25	0.0625	1	
4	1	4	

Furthermore, the value of the eigenvector is multiplied by the original matrix, resulting in a value for each row, which is then divided back into the respective vector.

Average value In the result of this division is the maximum principal eigen value (λ_{max}).

$\lambda_{max} = 4.000$

Consistency index value (CI) obtained:

$$CI = \frac{(\lambda_{max}-n)}{(N-1)} = \frac{(4.000-4)}{(4-1)} = -0.000$$

For N = 4 RI = 0.900

CR = CI = -0.000 = 0.000 consistent

RI = 0.900

Because $CR \leq 0.1$ means that the preferences of the teachers are consistent with the results of the calculations in the table above, it shows that the science major must have more dominant science skills, followed by Mathematics and also followed by Indonesian than other subjects from here. we can find out that prospective students who are dominant in these subjects have talent in the science department.

*name of corresponding author



IPS				
	IPS	MTK	BAHASA INDO	IPA
IPS	1	1.4	2.333333333	7
Bahasa indo	0.714285714	1	1.666666667	5
MTK	0.428571429	0.6	1	3
IPA	0.142857143	0.2	0.333333333	1
TOTAL	2.285714286	3.2	5.333333333	16

The parameters of the Social Studies major, it is obtained as follows:

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The eigenvector values are generated from the average relative weights for each row.

The results can be obtained in the following table :

IPS	MTK	BAHASA INDO	IPA	jumlah
0.4375	0.4375	0.4375	0.4375	1.75
0.3125	0.3125	0.3125	0.3125	1.25
0.1875	0.1875	0.1875	0.1875	0.75
0.0625	0.0625	0.0625	0.0625	0.25
1	1	1	1	4

prioritas	eigent vektor	lamday
0.4375	1	4
0.3125	1	
0.1875	1	
0.0625	1	
1	4	

Furthermore, the value of the eigenvector is multiplied by the original matrix, resulting in a value for each row, which is then divided back into the respective vector.

Average value In the result of this division is the maximum principal eigenvalue (λ_{max}).

$$\lambda_{max} = 4.000$$

Consistency index value (CI) obtained:

$$CI = \frac{(\lambda_{max}-n)}{(N-1)} = \frac{(4.000-4)}{(4-1)} = -0.000$$

For N = 4 RI =0.900

$$CR = \frac{CI}{RI} = \frac{=0.000}{0.900} = 0.000 \text{ consistent}$$

Because $CR \leq 0.1$ means that the preferences of the teachers are consistent with the results of the calculations in the table above, it shows that the Social Studies major must have more dominant social studies skills, followed by Indonesian and followed by the language of mathematics than other subjects from Here we can find out that prospective students who are dominant in these subjects have talent in the science department.

3. career opportunities

Paired matrices for the main criteria of questionnaire data processing then produce the following table :

*name of corresponding author



	IPA	IPS
IPA	1.000	5.000
IPS	0.200	1.000
total	1.200	6.000

By dividing the elements in each column by the number of the corresponding column, a normalized relative weight will be obtained. The eigenvector values are generated from the average relative weights for each row. The results can be obtained in the following table:

Normalisasi			
	IPA	IPS	Jumlah
IPA	0.833333333	0.833333333	1.666666667
IPS	0.166666667	0.166666667	0.333333333

Prioritas	eigen vektor	lamda maks
0.833333333	1	2
0.166666667	1	
1	2	

Furthermore, the value of the eigenvector is multiplied by the original matrix, resulting in a value for each row, which is then divided back into the respective vector.

Average value In the result of this division is the maximum principal eigenvalue (λ_{max}).

$$\lambda_{max} = 2.000$$

Consistency index value (CI) obtained:

$$CI = \frac{(\lambda_{max} - n)}{(N-1)} = \frac{(2.000 - 2)}{(2-1)} = 0.000$$

For N = 4 RI = 0.900

$$CR = \frac{CI}{RI} = \frac{0.000}{0.900} = 0.000 \text{ consistent}$$

Because $CR \leq 0.1$ means that the preferences of the teachers are consistent from the results of the calculations in the table above, it shows below for Science career opportunities needed for now with a total of 0.83 Or in percentage it is described as follows 83% and it is known that Social Studies has a weight of 0,16 or in percentage it is translated to 16%, therefore we know for now that science career opportunities are very much used today.

RESULT

To determine the talent of the students we get from the questionnaire that is filled in by the students and then we input it into the parameters that we made earlier after that converting the results of the questionnaire into the weighting results that we have made based on the student's answers which are parameterized by the teachers.

We take the example of 2 prospective students to try to see if they are suitable for the science / social science major:

NAME : Ahmad ajih
School Origin : Smp 23
Major Interest : IPA
Subjects that he mastered: Bahasa Indonesia , IPA, Matematika

*name of corresponding author



Based on the questionnaire that was given, he admitted that he mastered Indonesian Mathematics and Science which we converted into the table that we had created. Then get as follows:

NAME : Ahmad Ajih
BOBOT IPA : 0.814
BOBOT IPS : 0.689

That is, for the science criteria, he gets a weight of 0.814 and for the social science criteria he gets a weight of 0.689. From here we can see that the talent of the child is more likely to major in science.

From the results of the questionnaire that was given to a prospective student named Ahmad Ajih, he showed that he was more interested in the science major. Then having talent in science and from the point of view of job opportunities obtained from teachers shows that science majors are more sought after for now, we convert them into the weight value that we created earlier, then we get for science a total weight of 0.814 and IPS gets a total weight of 0.689. Looking at the comparison, we know that this child is more suitable for science.

DISCUSSIONS

Although the selection of majors for prospective students with the AHP method has been able to give good results, further research should be better than this research. The suggestions that I give for further research to develop this research are:

From the managerial aspect, the author suggests that the selection of majors for prospective students is even better if they use the values they get compared to just knowing their honesty. 2. Based on the system aspect, the author provides suggestions for managing questionnaire data using the Expert Choice 11 application. While from the aspect of research, the author provides suggestions that future research is expected to build an application compared to manual calculations. where systematic calculations make it easier to manage data and also the scope is much wider and the possibility of human error is less.

CONCLUSION

Based on the results of research and discussion conducted, it can be concluded as follows:

In selecting majors for prospective students, using the Analytical Hierarchy Process (AHP) in Expert Choice 11 software can make it easier for prospective students to choose which major is the most appropriate for them, according to their interests, talents, and career opportunities. As well as by managing the questionnaire data, prospective students can get the right information regarding the selection of the right major. It can be concluded that the selection of majors using the AHP method is very helpful

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