Analytical Hierarchy Process Method to Determine Student Satisfaction Level with Academic Services

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ABSTRACT

Student satisfaction is an important aspect in the world of higher education that must be taken seriously. This is because students are the main stakeholders in the learning process and the development of educational institutions. The purpose of this research is to identify factors that affect student satisfaction with academic services and to apply the AHP method in determining the relative weight of each assessment factor that affects student satisfaction with academic services. The results showed that the AHP method helped weight alternatives and criteria with a weight scale of 1 - 9 according to the Saaty table, after weighting the alternatives, then ranking using the AHP method to get the final score, ranking 1 was obtained by Conducive Lecture Room with a final score of 0.084 and ranking 21 was obtained by Regulation with a final score of 0.037, therefore the level of student satisfaction with Conducive Lecture Room was the highest. The design of the application is carried out by conducting research in the academic science of UINSU by collecting student assessment data on academic services, after the data is collected, the weighting of each academic service is carried out and then entered into the application that has been built using the AHP method, influencing factors based on the weight of criteria and sub-criteria.

Keywords: AHP Method; Satisfaction Level; Service; Student

1. INTRODUCTION

UIN Sumatera Utara (UINSU) is a public Islamic university located in Medan, North Sumatra, Indonesia. UINSU's main focus is in the field of religious and Islamic sciences, but it also provides study programs in Science and Technology (Science and Technology) to meet the educational needs in that sector. The Science and Technology field at UINSU covers a wide range of study programs, including Biology, Information Systems, Computer Science, Mathematics, and Physics. Facilities provided include laboratories, lecture halls, libraries, computer facilities, and other supporting facilities relevant to teaching and learning activities and research in the field of Science and Technology. Lecturers and teaching staff in UINSU's Science and Technology field are experts and academics who are competent in the scientific fields they teach.

Student satisfaction is an important aspect in the world of higher education that must be taken seriously. This is because students are the main stakeholders in the learning process and the development of educational institutions. Student satisfaction reflects the extent to which students feel satisfied and fulfilled with their experience while studying at a university (Dan & Administration, 2020). Aspects that affect student satisfaction include teaching quality, facilities, academic services, curriculum quality, and interactions with lecturers and academic staff. Teaching quality is a major factor in increasing student satisfaction. Qualified lecturers, effective teaching methods, and a conducive learning environment are key elements that contribute to student satisfaction. In addition, adequate physical facilities and technology also play an important role in creating a positive learning experience. Efficient and responsive academic services also affect student satisfaction. Smooth registration, administration and academic assistance processes can increase satisfaction levels. Students also value good communication between them, lecturers, and academic staff (Aeni et al., 2020).

Evaluating the level of student satisfaction with academic services involves various aspects and criteria that are interrelated. In this case, the AHP method can be used to solve complex problems into a more organized hierarchical structure (Athiyah et al., 2021). This hierarchy can include main criteria, such as teaching quality, facility availability, academic support, etc., as well as more specific sub-criteria. Using the AHP method, this hierarchical structure can be processed and the relative weights for each criterion and sub-criteria can be determined. The AHP method allows

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pairwise comparisons between criteria and sub-criteria in terms of relative importance or preference (Nabila, 2023)(Bulan & Bulan, 2019). Through pairwise comparisons, students can provide comparison scores that reflect their level of preference for the criteria. This helps in determining the relative weight and priority of each criterion. In conclusion, student satisfaction is an important factor in improving the quality of education. Universities should continuously strive to improve the quality of teaching, facilities, academic services, curriculum, and interaction with lecturers and academic staff to ensure students are satisfied and successful in their studies (Reza Amri et al., 2020)(Afandi, 2018).

Research conducted by (Putri & Mahendra, 2019) with the title "Implementation of the Analytical Hierarchy Process (AHP) Method in the House Purchase Decision Support System in Tangerang City". The priority order of criteria in choosing a house to buy in the city of Tangerang is location, price, building specifications, developer credibility and payment methods. It is also known that the AHP method is very suitable for use in the decision-making process with multiple criteria and multiple alternatives. Because this method shows the results of weighting comparisons between criteria and alternatives. While the priority of housing selection from alternative decisions is Poris Residence, then I, and Kintamani. Other research conducted by (Dhamma et al., 2019) which is entitled "Analysis of Student Satisfaction Level with Student Service Center Services at Pelita Harapan University Medan with the Mamdami Fuzzy Method". Based on calculations that have been carried out using a matlab program with the input value of the Tangible variable 78, the input value of the Reliability variable 76, the input value of the Responsiveness variable 77, the input value of the Assurance variable is 74, and the input value of the Empathy variable is 79, the defuzzification results are obtained with an output value of 77.1 which means Satisfied. Based on the GUI program that has been built with the same input value and with the Fuzzy mamdani method, the defuzzyfication results are obtained with an output value of 77.12. Research conducted by (Noviyanti, 2019) entitled "Decision Support System in PPA Scholarship Acceptance using the Analytical Hierarchy Process (AHP) method". The study applied five criteria to get a PPA scholarship including Grade Point Average (GPA), parents' income, parents' dependents, semester and co/extracurricular achievements. Based on the priority scale, the ranking of the 5 five criteria used in the study is in order, namely GPA, parents' income, parents' dependents, semester and extra / co-curricular achievements. Determination of decision making using the AHP method in receiving PPA scholarships at Gunadarma University is appropriate for use in the process of selecting prospective scholarship recipients. In research (Ikhwan et al., 2019) entitled "Analyzing Customer Satisfaction Level Using Fuzzy Mamdani (Case Study: Busrain Bakery)". Based on the calculations that have been carried out, an input value of 8 is obtained for the taste of food and the domain [6 10]. That is, the food variable is good. The service input value is with the domain [3 7]. This means that the service quality variable is quite good. From the input given, the output of the customer satisfaction level is 85.96%, which means that customers are satisfied with the taste of food and the quality of service provided by Busrain Bakery Store. Research conducted by (Syahputra, 2021) entitled "Decision Support System in Determining the Level of Passenger Service Satisfaction at Lion Air Kualanamu International Airport with the AHP (Analytical Hierarchy Procces) Method" where the research results are The design of a decision support system using the AHP method is able to provide more effective decisions for determining the level of satisfaction of Loin Air airline passengers.

The purpose of the research is to identify factors that affect student satisfaction with academic services and to apply the AHP method in determining the relative weight of each assessment factor that affects student satisfaction with academic services. The expected contribution of the results of this study is to provide a deeper understanding of the factors that affect student satisfaction with academic services. By understanding the key factors that contribute to student satisfaction, educational institutions can take concrete steps to improve services and improve existing weaknesses. The use of the AHP method in this study provides a systematic and objective framework in determining the relative weights of the factors assessing student satisfaction. By obtaining accurate relative weights, educational institutions can make more optimal decisions in allocating resources, planning programs, and developing facilities to effectively meet student needs. By applying the AHP method, this research can provide insight into the advantages and disadvantages of this method in the context of assessing student satisfaction with academic services. This research can contribute to the knowledge and understanding of the use of the AHP method in assessing student satisfaction with academic services. The results of this study can be a reference for other researchers and academics who are interested in continuing similar research or developing more in-depth aspects of student satisfaction assessment.

2. LITERATURE REVIEW

2.1 Definition of Decision Support System

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A decision support system is an interactive system that supports the decision-making process through alternatives obtained from data processing, information and model design. In particular, SPK supports the work of a manager in solving problems by providing information or suggestions leading to certain decisions (Syahputra, 2021)(Noviyanti, 2019). So, the purpose of using a Decision Support System is to improve decision quality by reducing uncertainty, minimizing subjective bias, and providing objective guidance based on available data. By using data that is processed into information to make decisions from semi-structured problems.

2.2 Academic

The academic campus is the core of the higher education experience. It is the place where students go through their educational journey, pursue knowledge, and prepare themselves for the future. Within the academic campus, there are various aspects that play an important role in shaping students' learning experience and development. First, faculty and lecturers are the main pillars of the academic campus. They are the guides for students in their learning process, providing the necessary teaching, guidance and support. Competent and experienced lecturers play a key role in transferring knowledge and helping students develop their academic and professional skills. Secondly, the curriculum is at the heart of the academic experience on campus. It includes courses, programs of study, and other academic activities designed to shape students' understanding and skills. A relevant and up-to-date curriculum is key to ensuring students are prepared to face real-world challenges. In addition, campus facilities also play an important role. Laboratories, libraries, lecture halls and other facilities should support student learning and research. A comfortable and student-friendly campus creates an environment conducive to intellectual exploration and personal development. The academic campus is also a place where students can engage in extracurricular activities and student organizations. These are opportunities to develop leadership, social, and organizational skills that are essential for personal and professional growth. Lastly, campus ethos and culture play an important role in shaping the student experience. Values such as academic integrity, diversity, and respect for knowledge are implemented throughout the campus. A strong academic ethos promotes excellence and integrity among the academic community (Dan & Administration, 2020).

2.3 Analytical Hierarchy Process (AHP)

Analytical Hierarchy Process (AHP) is a technique to support the decision-making process that aims to determine the best choice from several alternatives that can be taken. AHP was developed by Thomas L. Saaty, a mathematician at the University of Pittsburgh in the United States around 1970, and has undergone many improvements and developments to date. AHP is also one of the methods that can be used to solve Multi Criteria Decision Making (MCDM) problems. Zimmermann suggests that MCDM is a decision-making method to determine the best alternative from a number of alternatives based on certain criteria. Criteria are usually in the form of measures, rules or standards used in decision making. Basically, the decision-making process is to have an alternative. The main tool of AHP is a functional hierarchy with the main input being human perception. The existence of a hierarchy allows complex or unstructured problems to be broken down into sub-problems, then organize them into a hierarchical form. The AHP method is one of the models for decision making that can help the human frame of mind. The basic thinking of the AHP method is the process of forming a numerical score to rank each decision alternative, preferably the alternative is matched with the decision maker's criteria. Before further examining the process of working the AHP method, it is necessary to consider the axioms of the AHP model. An axiom is something that cannot be disproved or that must occur. There are four axioms that must be considered in using the AHP model. These axioms consist of :

1. Reciprocal Comparison, which means that the pairwise comparison matrix formed must be opposite. $\frac{1}{k}$ For example, if A is k times more important than B then B is K times more important than A.
2. Homogeneity, which implies similarity in making comparisons. For example, it is not possible to compare 8 oranges with a tennis ball in terms of taste, but it is more relevant to compare in terms of weight.
3. Dependence, which means that each level has a relationship (complete hierarchy) although there may be an incomplete hierarchy.
4. Expectation, which means highlighting the assessment of the expectations and perceptions of decision makers. Assessments can be quantitative or qualitative data.
    In solving problems with the AHP method, there are basic principles that must be understood:
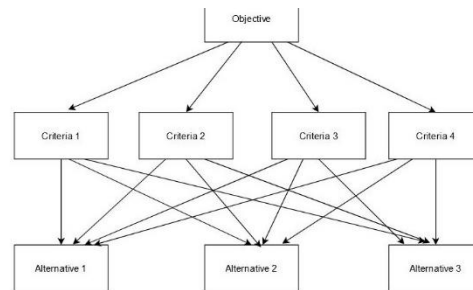a. Decomposition.

Fig.1 AHP structure (Putri & Mahendra, 2019)

The hierarchy in question is a hierarchy of problems to be solved to consider criteria or components that support the achievement of goals. In compiling a hierarchical structure, there are 3 levels that must be met, namely: First tier: Decision Objective (Goal), Second tier: Criteria, Third tier: Alternatives.

b. Comparative Judgement: This principle is done by making a pairwise comparison assessment of the relative importance of two elements at a given level of the hierarchy in relation to the level above it and assigning numerical weights based on the comparison. The results are presented in a matrix called Pairwise Comparison.

c. Synthesis of Priority: Synthesis is the stage to get weights for each hierarchical element and alternative element. From each Pairwise Comparison matrix, the eigenvector is then sought to obtain local priority. Because the pairwise comparison matrix exists at each level, then to get a global priority, synthesis between local priorities must be done. The ranking of elements according to relative importance through the synthesis procedure is called Priority Setting.

d. Logical Consistency: Consistency has two meanings, the first being that similar objects can be grouped according to uniformity and relevance. The second meaning concerns the degree of relationship between objects based on certain criteria.

The steps of AHP in making decisions are as follows:

1. Problems and alternative solutions are defined in detail, complete with various considerations that influence decision-making.
2. The results of step 1 are expressed in the form of a hierarchical structure.
3. The contribution or influence of each consideration to the consideration above it is expressed in a pairwise comparison matrix. This step is done for all levels.
4. Determine the eigen vector (can be taken corresponding to the largest eigen value) or the average value of the normalized weight of each pairwise comparison matrix. The value in this vector is the value of the contribution of each consideration. This value is used to give weight to the next level.

2.4 PHP (Hypertext Preprocessor)

PHP (Hypertext Preprocessor) is a scripting language commonly used for web development. PHP was created by Rasmus Lerdorf in 1994, and has since grown to become one of the most popular programming languages for web development. PHP is a server-side programming language designed for web development, but it is also used as a general programming language. PHP can be inserted into HTML and combined with various databases, including MySQL, PostgreSQL, Oracle, Sybase, Informix, and Microsoft SQL Server (Teknologi et al., 2021). PHP's advantages lie in its ease of use, good performance, and extensive community. Many well-known platforms and frameworks such as WordPress, Drupal, and Laravel are built using PHP. This makes PHP a top choice for many web developers, both for small and large projects. In addition, PHP has many libraries and tools that support web application development, such as libraries for image manipulation, user authentication, and email delivery. With strong community support and continuous updates, PHP remains a relevant and effective language for modern web development.

3. METHOD

This research was conducted at Jl. Lap. Golf No.120, Kp. Tengah, Kec. Pancur Batu, Deli Serdang Regency, North Sumatra 2035. In this study, researchers used two research variables, namely one independent variable and one

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dependent variable. The various variables are:
1. Free Variable (X): Independent variables are variables that affect or cause changes or the emergence of dependent variables. In this study, the independent variables are academic services in the form of tangible evidence (tangible), reliability, responsiveness, assurance, care (empathy).
2. Bound Variable (Y): The dependent variable is the variable that is affected because of the independent variable (which affects). The dependent variable in this study is the level of student satisfaction.

In measuring student satisfaction, the scale used is a Likert scale. The Likert scale is used to measure the attitudes, opinions, and perceptions of a person or group of people about a phenomenon.

Table 1
Scoring Technique

No.	Category	Answer/Scores	
		Positive (+)	Negative (-)
1	Strongly Disagree	1	5
2	Disagree	2	4
3	Disagree	3	3
4	Agree	4	2
5	Strongly Agree	5	1

Determine the final score with a percentage number, namely with the formula: $p = \frac{f}{N} x100\%$ (1)

Information: p = percentage number, N = ideal score, f = acquisition score

Table 2.
Input Variables

Variables	Sub Variables	Indicator
Service Quality	Tangible	1. Physical facilities 2. Learning support media
	Reliability	1. On-time delivery 2. Compatibility
	Responsiveness	1. Response and readiness of lecturers, academic staff 2. Service time flexibility
	Assurance	1. Knowledge 2. Politeness
	Empathy	1. Attention 2. Concern for student interests 3. Friendliness

Table 3
Categories of Student Satisfaction

Satisfaction Category	Range
Not Satisfied	$0 \leq x \leq 40$
Quite Satisfied	$20 \leq x \leq 60$
Satisfied	$40 \leq x \leq 80$
Very Satisfied	$60 \leq x \leq 100$

The research framework is a scheme that divides the stages carried out in classifying research. The function of the research framework is to determine the direction and provide an overview in the process of making a Decision Support System application program. There are stages that must be done in completing this research in Figure 2 as follows.
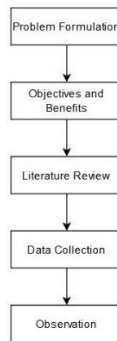
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Fig.2 Research Framework

The following is an explanation of the image above:

1. Problem formulation is the initial stage in the research or problem-solving process that aims to identify, detail, and clarify the problems to be solved.
2. The purpose of research is to gain an in-depth understanding of a topic or phenomenon, answer research questions, and generate new knowledge. Benefits include contributing to problem solving, theory development and sharing knowledge with the scientific community, which can be used to improve practice, policy and decision-making.
3. Literature review is an in-depth review of written sources relevant to the research topic. It involves the identification, analysis, and synthesis of existing literature to understand the latest developments, conceptual frameworks, and findings related to the research to be conducted.
4. Data collection is the process of gathering information or facts from various sources, such as surveys, interviews, and observations. The goal is to collect relevant and valid data that can be used for analysis, research, or evaluation, aiding understanding, decision-making, or problem-solving.
5. Observation is a systematic and planned process of observing objects, events, or phenomena to collect objective and accurate data. It involves the observer noticing, recording, and analyzing the information obtained without direct intervention or influence on the observed subject. Observation is used in a variety of contexts, from scientific research to the monitoring of human behavior.

To achieve a good system, good planning is also carried out. Therefore, the stages of making an analytical hierarchy process application to determine student satisfaction with Website-based academic services are found in Figure 3 below.
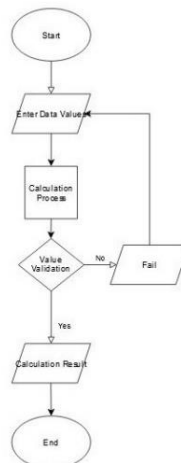

Fig.3 Research plan

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There are stages that must be done in completing this algorithm in Figure 4 below.
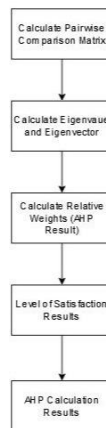

Fig.4 Research Process

The following is an explanation of the image above:

a. Calculating the Pairwise Comparison Matrix is one of the key steps in the Analytical Hierarchy Process (AHP) method. It involves the process of collecting relative preferences or comparisons between criteria or alternatives in a multi-criteria decision making.

b. Calculating eigenvalues and eigenvectors is an important part of matrix analysis, and it is often used in various mathematical and scientific applications. The process involves the use of linear algebra and matrices.

c. Calculating relative weights or AHP (Analytical Hierarchy Process) results is an important stage in the AHP method used to determine the relative weights of criteria or alternatives in a multi-criteria decision making. This weight reflects the level of importance of each criterion or alternative in the context of the decision at hand.

   Step 1= $x = Cn - Cm$ (2)

   Step 2= If $x = 0$ then $y = 1$, If $x = -1$ OR 1 then $y = 2$, If $x = -2$ OR 2 then $y = 3$, If $x = -3$ OR 3 then $y = 4$, If $x = -4$ OR 4 then $y = 5$, If $x = -5$ OR 5 then $y = 6$, If $x = -6$ OR 6 then $y = 7$, If $x = -7$ OR 7 then $y = 8$, If $x = -8$ OR 8 then $y = 9$ (3)

   Step 3= If $x <= 0$ then $1 / y$ If $x >= 0$ then $(cx = y / 1) = cx = y / 1$ (4)

d. Satisfaction Outcome Level is a measure used to evaluate the extent to which a particular student or experience is satisfied with their experience. It is often used in surveys or research to measure satisfaction.

e. AHP calculation results are the output of the Analytic Hierarchy Process (AHP) method used to determine the relative weights or priorities between criteria or alternatives in a multi-criteria decision making. These results reflect the importance of each element in the context of the decision at hand (Munthafa et al., 2017)(Supriadi et al., 2018)(Anggi Ilham Hadi Siregar, 2019).

4. RESULT

4.1 Problem Identification

Although the above subchapters have explained in general terms the stages of research, this section explains problem identification in more detail. It should be recognized that the problem identification stage is not an easy thing to do. Problem identification is the initial part of the research that must be carried out by the researcher. Researchers need to describe the identification of the problem so that the research problem becomes clear in the background of the problem, the following description results will be discussed:

1. Availability of Laboratory Facilities: Some students felt that the available laboratory facilities could still be improved to optimally support practicum activities.

2. Adequate Library: Students want an increase in the collection of books and digital resources in the library to support their studies.

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3. Conducive Lecture Hall: Students expect more comfortable and functional lecture halls to improve concentration and comfort during lectures.
4. Academic Consultation Services: Lecturers' time and availability for consultation outside lecture hours can be more flexible to help students who need additional guidance.
5. Relevant Course Materials: Students want course materials that are up-to-date with the latest developments in their field of study.

4.2 Data Collection Technique

In analyzing and designing a good system, the right data and information is needed and in accordance with the needs of the system. This can be obtained by analyzing the previous or running system. Because from this information, it can be seen to what extent the system is currently running, the data obtained is the result of observation and is obtained from the results of collection in the form of softcopy then for weighting the criteria an interview is conducted. The following is how to determine the criteria and alternatives in making decisions in the academic section of UINSU, namely:

1. Determine the criteria used in decision making to determine what academic services are most influential in student assessment. Criteria used in academics.

Table 4
Criteria for Academic Service Satisfaction

Code	Criteria
C1	Strongly Disagree
C2	Disagree
C3	Disagree
C4	Agree
C5	Strongly Agree

Source: (Akademik Saintek UINSU)

The table above is a table of criteria that have been obtained from the results of research in the academic science of UINSU.

2. Determining the alternatives to be used by taking data in the form of soft copies provided by the academics, where the data obtained is only information such as what academic services need to be improved.

Table 5
Alternatives to Academic Services

Code	Alternative
A1	Friendly Academic Parties Outside
A2	Lecturer's Instructions Are Clear Enough
A3	Conducive Lecture Hall
...	...
A21	Academic Consultation Service

Source: (Akademik Saintek UINSU)

The table above is an alternative table that has been obtained from the results of research in the academic science of UINSU .

4.3 Application and Usage

Implementation is the process of applying the program design that has been made in the previous chapter or application in implementing the programming information system that has been made, the results and stages of this implementation are a data processing system that can run well. Weighting of criteria and sub-criteria from a range of 1-9 according to the saaty table.

1. Methods AHP

The Saaty table is a comparison weighting table in the AHP algorithm, this table is used as a weighting or comparison between alternatives/criteria.

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Table 6
Saaty Scale

Value	Definition
1	Equally Important
3	More Important Little
5	Stronger Importance
7	More Important Very Strongly
9	Extream Importance
2,4,6,8	When Undecided Between Two Adjacent Values
Reversal	If element i has one of the above numbers when compared to element j, then j has the opposite when compared to element i.

2. Then determine the weighting of criteria according to AHP provisions where the weighting of a scale of 1 - 9 is obtained based on the results of interview research to determine the weight of each criterion.

Table 7. Criteria Weighting

Code	Criteria	Weight
C1	Strongly Disagree	1
C2	Disagree	2
C3	Disagree	3
C4	Agree	4
C5	Strongly Agree	5

Source: (Akademik Saintek UINSU**)**

The greater the weight of the criteria, the greater the influence of the criteria in AHP ranking, here the greatest influence of the criteria Strongly Agree which contains a weight of 5.

3. Comparison between criteria according to the weighting is started with the calculation as below.
   Inter-Criteria Comparison Formula:

Table 8
Inter-criteria Comparison

Code	C1	C2	C3	C4	C5
C1	1	0,50	0,33	0,25	0,20
C2	2,00	1	0,50	0,33	0,25
C3	3,00	2,00	1	0,50	0,33
C4	4,00	3,00	2,00	1	0,50
C5	5,00	4,00	3,00	2,00	1
Total	15,00	10,50	6,83	4,08	2,28

4. Normalization by converting elements in a pairwise comparison matrix into proportional values that are on the same scale, thus facilitating comparison and calculation of relative weights. Criteria Normalization Formula: $N_{ij} = \frac{a_{ij}}{\Sigma_{i=1}^{n} a_{ij}}$

$$ (5) $$

Manual Calculation: $N_{1,1} = 1 / 15 = 0,067$, $N_{1,2} = 0,50 / 10,50 = 0,048$, $N_{2,1} = 2 / 15 = 0,133$, $N_{2,2} = 1 / 10,50 = 0,095$

Table 9
Criteria Normalization

Code	C1	C2	C3	C4	C5
C1	0,067	0,048	0,049	0,061	0,088

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C2	0,133	0,095	0,073	0,082	0,109
C3	0,200	0,190	0,146	0,122	0,146
C4	0,267	0,286	0,293	0,245	0,219
C5	0,333	0,381	0,439	0,490	0,438

5. Next, calculate the average weight of the criteria.

Criteria Weight Average Formula: $W_i = \frac{\sum_{j=1}^{n} N_{ij}}{n}$ (6)

Manual Calculation: $W_1 = (0{,}067 + 0{,}048 + 0{,}049 + 0{,}061 + 0{,}088) / 5 = 0{,}062$, $W_2 = (0{,}133 + 0{,}095 + 0{,}073 + 0{,}082 + 0{,}109) / 5 = 0{,}099$

Table 10
Average Weight of Criteria

Code	Priority Weight
C1	0,062
C2	0,099
C3	0,161
C4	0,262
C5	0,416

6. CM (Consistency Measure) is obtained from multiplying the pairwise comparison matrix A by the weight vector W, and the largest eigenvalue is the key part of the consistency calculation. You can calculate it in the following way: Consistency Measure Formula: $AW = \lambda_{max} W, \lambda_{max} = \frac{(AW)_i}{W_i}$ (7)

Manual Calculation: $CM_1 = ((1{*}0{,}062) + (0{,}50{*}0{,}099) + (0{,}33{*}0{,}161) + (0{,}25{*}0{,}262) + (0{,}20{*}0{,}416))/5 = 5{,}035$

Table 11
Consistency Measure

Code	Consistency Measure
C1	5,035
C2	5,023
C3	5,060
C4	5,108
C5	5,115
Average	5,068

7. CI is calculated using the largest eigenvalue of the pairwise comparison matrix and the number of criteria. The CI formula is as follows: Consistency Index Formula: $CI = \frac{\lambda_{max} - n}{n - 1}$ (8)

Manual Calculation: $CI = (5{,}068{-}5) / (5{-}1) = 0{,}017$

Table 12
Consistency Index

Consistency Index
0,017

8. The Consistency Ratio (CR) is calculated to assess whether the pairwise comparisons are consistent enough. CR is calculated by the formula:

Table 13
Index Ratio

n	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,46	1,49	1,51	1,48

Consistency Ratio Formula: $CR = \frac{CI}{RI}$ (9)

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Manual Calculation: CR = 0.017 / 1.12 = 0.015

Table 14
Consistency Ratio

Consistency Ratio
0,015

If CR is smaller than 0.1, the AHP calculation is successful and the weighting of criteria is optimal and in accordance with the provisions, where 0.015 < 0.1, it is considered consistent weighting.

9. Furthermore, alternative weighting is based on softcopy data that has been obtained, the data to be calculated totals 21 alternatives or academic services and there are 153 students who provide assessments.

Table 15
Alternative Value Based on Criteria Year 2023

Code	C1	C2	C3	C4	C5	Total
A1	20	30	25	23	55	153
A2	47	21	30	23	32	153
A3	7	2	31	56	57	153
...	...	...	...	...	...	...
A21	43	26	40	29	15	153

Source: (Akademik Saintek UINSU)

10. Change the assessment of the research site according to the provisions of the sub-criteria weighting that has been obtained according to the sub-criteria weighting table in the research results.

Table 16
Changing Alternative Ratings with Subcriteria Weights

Code	C1	C2	C3	C4	C5
A1	2	2	2	2	4
A2	3	2	2	2	2
A3	1	1	2	4	4
....	...	...	...	...	...
A21	3	2	3	2	1

11. Final Score and Ranking

Table 18
Criteria Priority Weight

Criteria	C1	C2	C3	C4	C5
Priority Weight	0,062	0,099	0,161	0,262	0,416

Table 19
Alternative Priority Weight

Code	C1	C2	C3	C4	C5
A1	0,032	0,039	0,036	0,037	0,109
A2	0,060	0,039	0,036	0,037	0,036
A3	0,019	0,021	0,036	0,113	0,109
...	...	...	...	...	...
A21	0,060	0,039	0,069	0,037	0,020

* Corresponding author

Table 20
Final Score and Ranking of Alternatives

Code	Alternative	Value	Rank
A1	Friendly Academic Parties Outside	0,067	2
A2	Lecturer's Instructions Are Clear Enough	0,038	18
A3	Conducive Lecture Hall	0,084	1
....	.....	...	...
A21	Academic Consultation Service	0,037	20

4.4   Testing

This testing stage is a stage intended to determine whether each function in the system is functioning in accordance with the design made. At the testing stage, it is done by using a web application with a web browser media, namely Google Chrome. Testing is done by observing the results of execution through test data and checking the functionality of the software. This testing phase is carried out using localhost as a test server. The following are the results of the tests carried out:

1. Here the user logs in so that he can enter the supporting system application to determine the level of academic services.
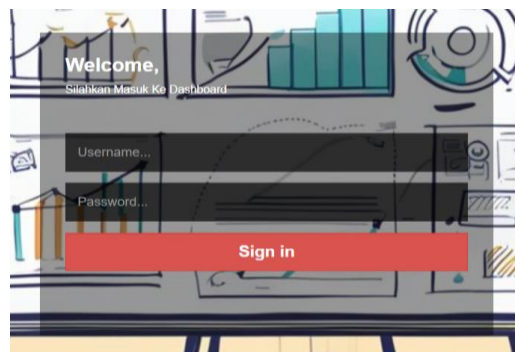

Fig.5 Web Application Login Page

The picture above is an application view of the login page, the user must log in to manage application access.
2. Next, enter the dashboard and the number of alternatives and criteria appears on the home page.
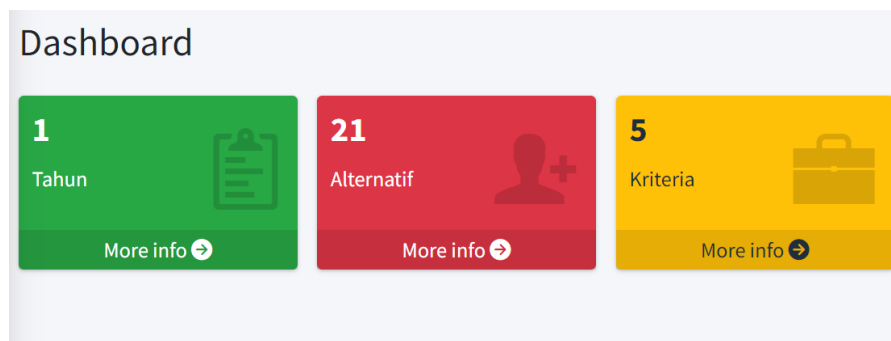

Fig.6 Display of Number of Alternatives and Criteria

After the user enters, it will display the main page, namely the dashboard, which contains the number of alternatives, criteria and years according to user input.
3. Display Criteria.

* Corresponding author

No	Kode	Kriteria	Action
1	C1	Sangat Tidak Setuju	✏️ 🗑️
2	C2	Tidak Setuju	✏️ 🗑️
3	C3	Kurang Setuju	✏️ 🗑️
4	C4	Setuju	✏️ 🗑️
5	C5	Sangat Setuju	✏️ 🗑️

Fig. 7 Data Criteria

The criteria menu where the user enters what criteria will be carried out in the ranking process, here the user enters the criteria, edit and delete.

4. Displays alternatives, weights and final values, where the final value is an AHP calculation in determining ranking.

No	Kode	Alternatif	C1	C2	C3	C4	C5	C6	C7	C8	Nilai	Rank
1	A1	Mutiara Pupuk NPK 16-16-1	1 kg, 5 kg, 10 kg	18,000 - 95,000/kg	Pupuk Kimia	Granular	16	16	16	Tidak spesifik	0.8150	2
2	A2	NPK 10-55-10	1 kg, 5 kg	18,000 - 95,000/kg	Pupuk Kimia	Granular	10	55	10	Tidak spesifik	0.7150	5
3	A3	Pupuk Gandasil B - Pupuk	100 g, 500 g	10,000 - 40,000/kg	Pupuk Kimia	Serbuk	6	20	30	Mengandung Mg	0.6550	14

Fig. 8 Displaying Alternative Ranking and Final Score

The picture above shows the alternatives and alternative weighting for the ranking process based on the highest final value.

5. Determining alternative weights based on each criterion.

Alternatif

Mutiara Pupuk NPK 16-16-1

C1(Ukuran Kemasan)

100 g, 500 g

C2(Harga)

8,000 - 22,000/100g

C3(Jenis Pupuk)

Pupuk Kimia

C4(Bentuk)

Granular

C5(Kandungan N)

Bervariasi

C6(Kandungan P)

Bervariasi

C7(Kandungan K)

Bervariasi

C8(Kandungan Mg)

Mengandung Mg

Update

Fig. 9 Saving Alternative Weights Based on Criteria

* Corresponding author

The picture above displays when the user adds alternative weights from each criterion.

6. Display and sort largest to smallest values with a pdf report.

No	Kode	Alternatif	C1	C2	C3	C4	C5	C6	C7	C8	Nilai	Rank
19	A19	Gaviota Bunga 67 13-27-27	1 kg, 5 kg	18,000 - 95,000/kg	Pupuk Kimia	Granular	13	27	27	Tidak spesifik	0.8150	1
1	A1	Mutiara Pupuk NPK 16-16-1	1 kg, 5 kg, 10 kg	18,000 - 95,000/kg	Pupuk Kimia	Granular	16	16	16	Tidak spesifik	0.8150	2
15	A15	NPK Mutiara 16-16-16	1 kg, 5 kg, 10 kg	18,000 - 95,000/kg	Pupuk Kimia	Granular	16	16	16	Tidak spesifik	0.8150	3
12	A12	Pupuk Daun dan Tanaman Hi	1 kg, 5 kg	95,000 - 190,000/kg	Pupuk Pelepas Lambat	Granular	17	11	10	Tidak spesifik	0.7300	4

Fig. 10 Displaying and Sorting Final Grades

To view and print to find out the ranking results report can be done using the pdf extension in the application.

7. Display the model and manual calculation of MAUT

BOBOT DAN TIPE KRITERIA

Kode	C1	C2	C3	C4	C5	C6	C7	C8
Bobot	0.1	0.15	0.1	0.1	0.2	0.15	0.15	0.05
Tipe	benefit	cost	benefit	benefit	benefit	benefit	benefit	benefit

NORMALISASI

O	C1	C2	C3	C4	C5	C6	C7	C8
A1	1	0.5	0.8	1	1	0.8	0.8	0.4
A2	0.8	0.5	0.8	1	0.6	1	0.6	0.4
A3	0.2	0.5	0.8	0.8	0.4	0.8	1	1
A4	0.6	0.5	1	0.8	0.6	0.6	0.6	1
A5	0.4	1	1	0.8	0.4	0.4	0.4	0.4
A6	0.6	0.5	0.8	0.8	0.6	0.6	0.6	1
A7	0.8	0.5	0.6	1	0.6	0.6	0.6	1
A8	0.6	0.33333333333333	0.8	0.8	0.6	0.6	0.6	1

Fig. 11 Displaying MAUT Model and Calculation

The picture above is a display of manual calculation or ranking process with MAUT method.

5. CONCLUSION

Based on the results of research on decision support systems in determining patients for priority treatment in academics, the authors conclude that using the AHP method helps weighting alternatives and criteria with a weight scale of 1 - 9 according to the Saaty table, after weighting the next alternative ranking using the AHP method to get the final score, ranking 1 is obtained by Conducive Lecture Room with a final score of 0.084 and ranking 21 is obtained by Regulation with a final score of 0.037, therefore the level of student satisfaction with Conducive Lecture Room is the highest. The design of the application is carried out by conducting research in the academic science of UINSU by collecting student assessment data on academic services, after the data is collected, the weighting of each academic service is then entered into the application that has been built using the AHP method, influencing factors based on the weight of criteria and sub-criteria.

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