Analysis of the Laboratory Assistant Recruitment Selection Determination System using the TOPSIS Algorithm Method in the Computer Lab

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Abstract

Laboratory assistants are students appointed by the laboratory and accompany lecturers during practical activities. The process of accepting computer laboratory assistants has several assessment criteria, both academic and non-academic. Mistakes in decision making cause distrust of the accepted computer laboratory assistants and cause students to lack understanding and skills in certain courses. The research for the selection of laboratory assistants is based on the TOPSIS method, which is a decision-making method based on the idea that the chosen choice is the best choice that has the shortest distance to the positive ideal solution and the farthest distance to the negative ideal solution. There are five criteria used in the selection of computer laboratory assistants, including GPA, semester, programming test, personality and interview. This study aims to provide recommendations as considerations for making decisions appropriately and is expected to facilitate the process of selecting computer laboratory assistants that are in accordance with student abilities, based on standard criteria and test results.

Keywords : *laboratory assistant, topsis algorithm, computer laboratory .*

Abstract

Laboratory assistants are students appointed by the laboratory and accompany the lecturer during practical activities. The process for accepting computer laboratory assistants has several assessment criteria, both academic and non-academic. Errors in decision making cause distrust of computer laboratory assistants who are accepted and cause students to lack understanding and skills in certain subjects. This research for the selection of laboratory assistants is based on the TOPSIS method, which is a decision making method based on the idea that the option chosen is the best option that has the shortest distance to the positive ideal solution and the farthest distance to the negative ideal solution. There are five criteria used in selecting computer laboratory assistants, including GPA, semester, programming test, personality and interview. This research aims to provide recommendations as material for consideration for appropriate decision making and is expected to facilitate the process of selecting computer laboratory assistants that suit students' abilities, based on standard criteria and test results.

Keywords *: laboratory assistant, algorithm topsis, computer lab.*

1. Introduction

Practicum is an academic activity that aims to observe, experiment, understand and apply the theories learned in lectures by practicing them in the laboratory room [1]. The existence of a computer laboratory assistant plays a very important role in ensuring the quality of graduates, laboratory assistants are required to follow all processes related to the computer laboratory under the leadership of a laboratory assistant. A laboratory assistant is a student appointed by the laboratory and accompanies the lecturer during the practical activities [2] , [3]. According to needs, the selection of computer laboratory practicum assistants is carried out every semester. The computer laboratory manager has the main task of making decisions about accepting computer laboratory assistants, which is very important for management. This

decision must be made between various options to select the best candidate to become a computer laboratory assistant. Mistakes in decision making cause distrust of the accepted computer laboratory assistants and cause students to lack understanding and skills in certain courses [4]. One way to overcome this problem is to have a method that can provide recommendations as a basis for good decision making.

Decision Support System is a systematic approach to solving problems, collecting facts and data, and identifying the right alternatives to make the most appropriate decision. In other words, DSS is a systems science methodology for solving problems using a scientific approach. DSS is specifically developed to assist decision making when choosing a particular option [5]. Decision Support System can provide additional input to decisions, so that in the process of assessing the potential of prospective laboratory assistants, a computer system called Decision Support System *(* DSS *) is created* .

This research for the selection of laboratory assistants is based on the TOPSIS method, which is a decision-making method based on the idea that the chosen option is the best option that has the shortest distance to the positive ideal solution and the farthest distance to the negative ideal solution [3]. Based on previous research that has been conducted regarding the determination of the selection of laboratory assistants, which relate to the same research methods, topics, or case studies, or different research topics with the same method, the same case study with a different method, so the author uses a reference for this research, as written by Jaidup Banjarnahor (2022) [6], which uses the TOPSIS method, besides that there is also the SAW method by Triana Elizibeth et al, (2020) [7], and the ELECTRE method by Rini Rahayu Valentina et al (2021). However, there are also researchers who combine 2 methods, namely the Application of the AHP Method and the TOPSIS Method In Determining Computer Laboratory Assistants conducted by Nia Nailil Farih et al, (2023) [9].

From several journal references listed above, this study aims to provide recommendations as a consideration for making decisions appropriately and is expected to facilitate the process of selecting a computer laboratory assistant that suits the student's abilities, based on standard criteria and test results. This makes the selected laboratory assistant more accurate and in accordance with the student's abilities. the .

2. Research methods

2.1 Stages Study

There are some necessary steps done researcher .

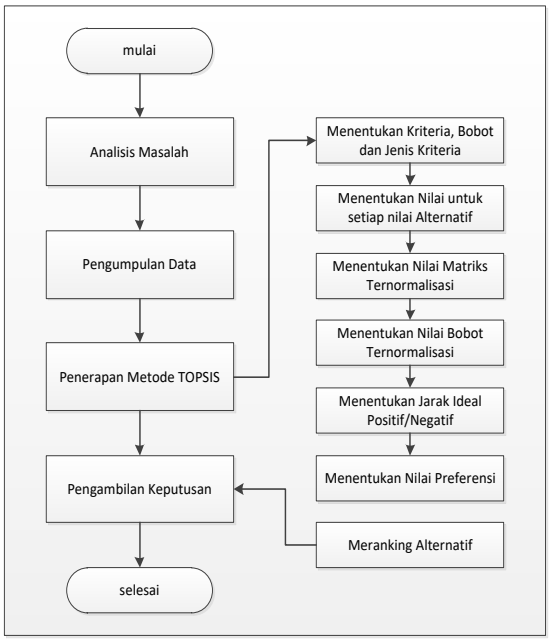

Figure 1. Flowchart Study

1. Analysis Problem
   Analysis Problem used For analyze problem moment This And find the solution .
2. Data collection

Methods used For gather material study real that requires systematic steps And strategic For get valid data and in accordance with reality .

3. Implementation TOPSIS method
   The process of taking decision through calculation And ranking For find alternative best .
4. Retrieval Decision
   After the calculation process And ranking use TOPSIS method completed , alternative choice made For used in taking decision .

2.2 *Technique for Order Preference by Similarity to Ideal Solution* (TOPSIS)

The TOPSIS method can solve MADM problems, which makes it very practical for solving a decision. In addition, this method produces successful alternative choices through the calculation and ranking process, which produces the best choice based on predetermined criteria, which can be used as a decision-making solution [3], [10].

By using the TOPSIS method, alternatives can be determined, alternatives based on their relative proximity in the optimal solution and the positive ideal solution. The steps for implementing the TOPSIS method [10] are as follows:

1. Creation of a normalized provision matrix
$$r_{ij=}\frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \quad (1)$$
2. Creation of a matrix with assessed and normalized terms
$$y_{ij} = w_i\, r_{ij} \quad (2)$$
3. The normalized rank values $(y_{ij})$are used to determine the positive optimal solution A $^{+}$ and the negative optimal solution A– .
$$A^{+} = (y_1^{+}, y_2^{+}, .., y_n^{+}) \quad (3)$$
$$A^{-} = (y_1^{-}, y_2^{-}, .., y_n^{-})$$
4. Make sure that the range of values of each option is complemented by a matrix of positive and negative optimal solutions.
$$D_i^{+} = \sqrt{\sum_{i-1}^{n} \quad (v_i^{+} - v_{ij})^2} \quad (4)$$
$$D_i^{-} = \sqrt{\sum_{i-1}^{n} \quad (v_{ij} - v_i^{-})^2}$$
5. Calculate the number of preferences for each option using the equation
$$v_i = \frac{d_i^{-}}{d_i^{-} - d_i^{+}} \quad (5)$$
6. Ranking of alternatives
   Once the preference calculations are complete and their values are obtained, each option is ranked from smallest to largest in order of value.(V_i)

3. Results and Discussion

In the TOPSIS method, the best alternative is obtained from the calculation process and then ranked, so that the best alternative from the predetermined criteria can be used as a solution for decision making. The stages carried out are as follows:

1. The first stage is to determine participants who apply as computer laboratory assistants.
2. Selection criteria, namely the variables used to assess and select computer laboratory assistant candidates to be selected, including GPA, semester, programming test, personality, and interview.
3. Criteria Value, which shows the value for each defined criteria.
4. Criteria weighting, which means giving values according to the standards for accepting computer laboratory assistants.
5. Provide alternative values and normalization of alternative values to candidates applying for the position of computer lab assistant.
6. Perform calculations using the TOPSIS method, where the criteria are calculated by giving weight to the suitability of the criteria.
7. The selected alternative is the ranking stage, where selected participants will be recommended and ranked as computer laboratory assistants.

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3.1. Alternative Determination

Alternatives are objects that will be participants who apply for the position of computer lab assistant. The following is the participant name data as in Table 1.

Table 1. Participant Name Data

Number	Name Participant	Code Participant
1	Wise	P001
2	Inspiration	P002
3	Mom	P003
4	Icha	P004
5	Tiara	P005

3.2. Determination of Criteria

The criteria or attributes used as evaluation parameters in selecting computer laboratory assistants are as follows:

a. GPA Criteria

GPA is an academic value obtained by students during lectures, so it is taken into account in the selection of laboratory assistants. The higher the GPA, the higher the academic quality. The provisions of the GPA value are as shown in Table 2.

Table 2. GPA Value Provisions

Criteria	Provision Mark Criteria	Mark Criteria
GPA	<3.00	1
	3.00 – 3.30	2
	3.31 – 3.50	3
	3.51 – 3.80	4
	3.81 – 4.00	5

b. Semester Criteria

In the selection of laboratory assistants, semester is a consideration, because the higher the semester, the more insight and knowledge that has been obtained during lectures. The provisions of semester values are shown in Table 3.

Table 3. Semester Value Provisions

Criteria	Provision Mark Criteria	Mark Criteria
Semester	3	1
	4	2
	5	3
	6	4
	7	5

c. Criteria Test Programming

Programming tests are considered when selecting a computer lab assistant. This is because a Computer lab assistants must master programming skills that will later be taught to computer science students.

Table 4. Test Score Provisions Programming

Criteria	Provision Mark Criteria	Mark Criteria
Test Programming	<50	1
	50 - 65	2
	66 - 75	3
	76 - 85	4
	7	5

d. Criteria Personality

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In selecting a computer lab assistant, a person's personality is a consideration of the criteria, because a person with a good personality will make himself well-liked by the people around him. The provisions of personality values can be seen in Table 5.

Table 5. Personality Value Provisions

Criteria	Provision Mark Criteria	Mark Criteria
Personality	Very Not enough Good	1
	Not enough Good	2
	Enough	3
	Good	4
	Very Good	5

e. Criteria Interview
In selecting a computer lab assistant, an interview is one of the criteria considerations, because a lab assistant must have the ability to speak fluently, explain materials and answer student questions. The interview score requirements can be seen in Table 6.

Table 6. Interview Value Provisions

Criteria	Provision Mark Criteria	Mark Criteria
Interview	Very Not enough Good	1
	Not enough Good	2
	Enough	3
	Good	4
	Very Good	5

3.3. Determination Type And Weight criteria

Determination type criteria And weighting criteria required in taking decision because of type criteria That consists of from *benefits* And *cost* . *Benefit* is value obtained the more big so mark the the more good , while *cost* is the more low the value obtained , the more good . Weight criteria is percentage how much important component the value given by taker decision to criteria that have been given , value can in the form of 1 or 100 of all over existing criteria .

Table 7. Determination Type Criteria And Weight Criteria

Code Criteria	Criteria	Type Criteria	Percentage Weight
K001	GPA	Benefits	25
K002	Semester	Benefits	10
K003	Test Programming	Benefits	3 0
K004	Personality	Benefits	20
K005	Interview	Benefits	15
Total			100

3.4. Giving Mark Alternative And Normalization Mark Alternative

a. Giving Mark Alternative
Do evaluation to participants who apply For position assistant laboratory computer .

Table 8. Giving Mark Alternative

Name Participant	Criteria				
	K001	K002	K003	K004	K005
Wise	3.31	5	78	Very Good	Good

Inspiration	3.12	5	70	Enough	Enough
Mom	3.78	6	90	Good	Not enough
Icha	3.42	4	75	Good	Good
Tiara	3.65	4	80	Good	Good
					Good

b. Normalization Mark Alternative
Next , alternatives normalized in accordance with mark standard .

Table 8. Giving Mark Alternative

Name Participant	Criteria				
	K001	K002	K003	K004	K005
Wise	3	3	4	5	4
Inspiration	2	3	3	3	3
Mom	4	4	5	4	2
Icha	4	2	3	4	4
Tiara	3	2	4	4	4

3.5. Calculation Selection Reception Assistant Laboratory Computer

a. Determine Weight Divider Matrix
Before look for mark matrix normalization moreover formerly determine weight divider from every criteria , including the explanation as following :

$$x_1 = \sqrt{(3^2) + (2^2) + (4^2) + (3^2) + (4^2)} = 7{,}348$$

$$x_2 = \sqrt{(3^2) + (3^2) + (4^2) + (2^2) + (2^2)} = 6{,}481$$

$$x_3 = \sqrt{(4^2) + (3^2) + (5^2) + (3^2) + (4^2)} = 8{,}660$$

$$x_4 = \sqrt{(5^2) + (3^2) + (4^2) + (4^2) + (4^2)} = 9{,}055$$

$$x_5 = \sqrt{(4^2) + (3^2) + (2^2) + (4^2) + (4^2)} = 7{,}810$$

Table 10 shows results overall from the calculation process weight divider .

Table 10. Normalized Matrix Divisor Weights

Weight Divider	Mark Divider
X1	7,348
X2	6,480
X 3	8,660
X4	9,055
X5	7,810

b. Count Mark Matrix normalized
Step This started with add up every line squared matrix . Result summation from every line matrix rooted ; divisor from every line matrix is root from summation the .

$$A_1R_1 = \frac{3}{7{,}34846} = 0{,}408$$

$$A_2R_1 = \frac{2}{7{,}34846} = 0{,}272$$

$$A_3R_1 = \frac{4}{7{,}34846} = 0{,}544$$

$$A_4R_1 = \frac{4}{7{,}34846} = 0{,}408$$

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$$A_5R_1 = \frac{3}{7{,}34846} = 0{,}544$$

Following This is table results matrix normalized obtained from the calculation process on .

Table 11. Mark Matrix Normalization

Name Participant	Criteria				
	K001	K002	K003	K004	K005
Wise	0.408	0.463	0.462	0.552	0.512
Inspiration	0.272	0.463	0.346	0.331	0.384
Mom	0.544	0.617	0.577	0.442	0.256
Icha	0.408	0.309	0.346	0.442	0.512
Tiara	0.544	0.309	0.462	0.442	0.512

c. Count Mark Weight normalized
Step This done with multiplication mark matrix decision normalized with weight interest each as criteria determination reception assistant laboratory computer . As for the explanation as following :

$$A_1Y_1 = 0{,}408 \times 25\% = 0{,}102$$
$$A_1Y_2 = 0{,}408 \times 10\% = 0{,}046$$
$$A_1Y_3 = 0{,}408 \times 30\% = 0{,}139$$
$$A_1Y_4 = 0{,}408 \times 20\% = 0{,}110$$
$$A_1Y_5 = 0{,}408 \times 15\% = 0{,}077$$

Following results overall from the calculation process mark matrix normalized weighted like on Table 12 below This :

Table 12. Mark Matrix Normalization weighted

Name Participant	Criteria				
	K001	K002	K003	K004	K005
Wise	0.102	0.046	0.139	0.110	0.077
Inspiration	0.068	0.046	0.104	0.066	0.058
Mom	0.136	0.062	0.173	0.088	0.038
Icha	0.102	0.031	0.104	0.088	0.077
Tiara	0.136	0.031	0.139	0.088	0.077

d. Determine Matrix Positive Ideal Solution And Matrix Negative Ideal Solution
Weight rating normalized can used For determine positive ideal solution And negative . For know mark ideal solution , must be determine whether That benefit or cost (*cost*). The following results overall from the calculation process mark positive ideal solution And negative ideal solution like on Table 13 below This :

Table 2 3 . Positive Ideal Values and Negative Ideal

Criteria	Positive Ideal	Negative Ideal
K001	0.136	0.068
K002	0.062	0.031
K00 3	0.173	0.104
K004	0.110	0.066
K005	0.077	0.038

e. Determine range mark weighted on each alternative on positive optimal solution And negative optimal solution

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Objective from step This is For get the value to be used as reference For determine mark preference from every alternative . Calculation process mark distance proximity relatively to positive ideal solution (S^+) and negative ideal solution (S^-).

$$D_1^+ = \sqrt{(0{,}136 - 0{,}102)^2 + (0{,}062 - 0{,}046)^2 + (0{,}173 - 0{,}139)^2 + (0{,}110 - 0{,}110)^2 + (0{,}077 - 0{,}077)^2}$$

$$D_1^+ = \sqrt{(0{,}034)^2 + (0{,}016)^2 + (0{,}034)^2 + (0)^2 + (0)^2}$$

$$D_1^+ = \sqrt{(0{,}001156) + (0{,}000256) + (0{,}001156)}$$

$$D_1^+ = 0{,}051$$

$$D_1^- = \sqrt{(0{,}102 - 0{,}068)^2 + (0{,}046 - 0{,}031)^2 + (0{,}139 - 0{,}104)^2 + (0{,}110 - 0{,}066)^2 + (0{,}077 - 0{,}038)^2}$$

$$D_1^- = \sqrt{(0{,}034)^2 + (0{,}015)^2 + (0{,}035)^2 + (0{,}044)^2 + (0{,}039)^2}$$

$$D_1^- = \sqrt{(0{,}001156) + (0{,}000225) + (0{,}001225) + (0{,}001936) + (0{,}001521)}$$

$$D_1^- = 0{,}078$$

Following results overall from the calculation process distance from positive ideal value And negative ideal value like on Table 14 as following :

Table 3 4 . Range Positive Ideal Values and Negative Ideal

Name Participant	Mark Positive	Mark Negative
Wise	0.051	0.078
Inspiration	0.098	0.025
Mom	0.001	0.104
Icha	0.083	0.056
Tiara	0.046	0.088

f. Determine Mark Preference

Count mark preference from every choice with share mark negative ideal solution with results summation negative ideal value And positive ideal value .

$$V_1 = \frac{0{,}078}{0{,}078 + 0{,}051} = 0{,}604$$

$$V_2 = \frac{0{,}025}{0{,}025 + 0{,}098} = 0{,}200$$

$$V_3 = \frac{0{,}104}{0{,}104 + 0{,}001} = 0{,}992$$

$$V_4 = \frac{0{,}056}{0{,}056 + 0{,}083} = 0{,}402$$

$$V_5 = \frac{0{,}088}{0{,}088 + 0{,}046} = 0{,}656$$

Following This is table results mark preference every participants obtained from the calculation process on .

Table 4 5 . Results Mark Preference every Alternative

Code Participant	Name Participant	Mark Preference
P001	Wise	0.604
P002	Inspiration	0.200
P003	Mom	0.992
P004	Icha	0.402
P005	Tiara	0.656

g. Ranking to Alternative

After get mark preference like on Table 15 above , do ranking For find candidate best , code participant = P003 with Name Maman who has mark highest , so that become consideration

for determinant decision For become assistant laboratory computer , such as on Table 16 below This :

Table 5 6 . Ranking Alternative

Code Participant	Name Participant	Mark Preference	Ranking
P001	Wise	0.604	3
P002	Inspiration	0.200	5
P003	Mom	0.992	1
P004	Icha	0.402	4
P005	Tiara	0.656	2

4. Conclusion

Analysis of the laboratory assistant recruitment selection determination system carried out using the TOPSIS algorithm method in a computer laboratory that can help decision makers by providing references and solutions so that they can make the right decisions. In addition, by choosing the right laboratory assistant, it can help students if there are obstacles during the practicum and as a liaison with the lecturer so that the lecturer can understand the strengths and weaknesses of the student. The *Technique for Order Preference by Similarity to Ideal Solution* (TOPSIS) method can be applied in analyzing this because this method is a multi-criteria method and an easy-to-understand calculation process and the calculation results are in the form of a ranking of each alternative with the best candidate.

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