Analysis of the Factors Causing Lazy Students to Study Using the ELECTRE II Algorithm

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Abstract This study aims to search for factors causing lazy students at STIKOM Tunas Bangsa. Data obtained from student questionnaire results with a sample of 20 students. The attributes used are 4, namely body condition (A1), lack of learning motivation (A2), lecturer influence (A3) and environment (A4). The method used in the study is ELECTRE II. From the results of the study, the condition factor of the body (A1) is the first alternative to get the first rank with a pure concordance value of 1.8571 and a pure discordance value of -2. Followed by the influence factor of lecturer (A3) on the second rank with pure concordance value of 1.1905 and pure discordance value of -1.6935. With this analysis, it is expected that it can contribute to universities to pay attention to the lazy symptoms of lectures that can hinder students' success and pay attention to students based on ELECTRE II calculation analysis on the causes of lazy lectures so as to improve the educational process.

1. Introduction

Higher education is a place to gain knowledge for students where universities have a very important role in the learning process to develop students’ level of understanding. In the learning process, students have the provision to search, explore and explore the field of science by reading, observing, choosing reading materials to be studied which then poured in the form of scientific work used in student thesis writing. STIKOM Tunas Bangsa is one of the private universities in North Sumatra that is addressed at Jalan Jenderal Sudirman Blok A No.1 / 2/3 pematangsiantar engaged in computers. In carrying out educational activities, the academic field evaluates at the end of the semester for each lecture activity. In carrying out the lecture process, students are expected to be able to take part in teaching and learning activities well. But in the implementation many students who gave less attention when the learning process took place or intentionally the students did not attend the lecture. This is due to many factors such as poor body condition, no motivation to learn within, not having the right friends, low academic values, high levels of student stress, problems with the family, wrong majors, no college intentions and so on. This causative factor must be completely resolved and a solution is sought as the first step to overcome it. because it is necessary to create a system that can help solve all kinds of things that cause lazy lectures. The aim is as an initial mapping which then when the causes are known, it is likely that it will be easier to overcome and cure the lazy symptoms of college which can hamper student success. For institutions, this is an evaluation to improve the education process. Many branches of computer science can solve complex problems. This is evidenced by several studies in the field of datamining [1]–[8], field of artificial neural networks [9]–[13], in the field of decision support systems [14]–[18]. Based on this explanation, researchers used a decision support system to solve the problem above. In this case, the researcher uses the ELECTRE II
Method because the method can be used in conditions where suitable alternatives can be produced for cases with many \[19\]–\[22\]. This is evidenced by researchers \[23\] Where in this topic they propose the application of a model for GDSS multi-criteria in which simulation data are mutated genes that can cause cancer. This made the modelling flexible in accordance with the criteria established by the experts for decision making, so that the mutated gene for the determination of a person or not the criteria derived from expert opinion in the medical field. The other author\[22\], use ELECTRE to applied to case simulation, helps analyze the potential effects triggered by the absolute value of the maximum differentiated performance and the absolute value of the sum of differentiated performance under two discordance index evaluation standards. It is hoped that this research can contribute to universities in improving the teaching and learning process that is good at finding factors that cause students to be lazy to study objectively from several alternatives.

2. Methodology
2.1. Decision Support System
Decision Support Systems are computer-based systems that help solve problems and provide solutions to several problems that are not structured by several (sets) decision makers who work together as a group.

2.2. ELECTRE II
ELECTRE II’s evaluation method, developed by scholars Roy and Bertier (1971), represents an increase and promotion of ELECTRE I
The steps to complete the Electre II are as follows:
  a. Normalization of matrix values.
  b. Weighting on matrices that have been normalized
  c. Determine the concordance and discordance set.
  d. Calculates concordance and discordance matrices.
  e. Calculate pure concordance and pure discordance.
  f. Making rank by calculating the average of pure concordance and pure discordance.

2.3. Data Used
The data used in this study is the results of questionnaires from STIKOM Tunas Bangsa students in 2007-2018 (can be seen in Table 1). As for the student questionnaire data table, are as follows:

| No | Alternative | C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   | C10  |
|----|-------------|------|------|------|------|------|------|------|------|------|------|
| 1  | A1          | 3    | 3.9  | 3.5  | 3.5  | 4    | 3.75 | 3.75 | 4.25 | 3    | 3.5  |
| 2  | A2          | 2.15 | 2    | 3.5  | 2.3  | 3    | 2    | 3.75 | 3.75 | 2    | 3.3  |
| 3  | A3          | 2.6  | 3.8  | 3.3  | 4    | 3    | 3    | 3    | 4    | 3    | 4    |
| 4  | A4          | 2    | 3    | 3    | 2    | 3    | 3    | 3    | 4    | 3    | 2.75 |

| No | Alternative | C11  | C12  | C13  | C14  | C15  | C16  | C17  | C18  | C19  | C20  |
|----|-------------|------|------|------|------|------|------|------|------|------|------|
| 1  | A1          | 3    | 4    | 1.5  | 3    | 2.75 | 3.75 | 3    | 2    | 3    | 2    |
| 2  | A2          | 3    | 3.8  | 1.5  | 2.3  | 3.75 | 3    | 2    | 3    | 3.25 | 2.25 |
| 3  | A3          | 4    | 3    | 3    | 3.5  | 3.85 | 3    | 2.8  | 2.6  | 4.2  | 3    |
| 4  | A4          | 3    | 2.5  | 2    | 1    | 2.25 | 2.75 | 1.25 | 2    | 5    | 2    |

2.4. Weighting values
The results of the weighting of each criterion can be seen in table 2, as follows:

| Criteria | C1   | C2   | C3   | C4   | C5   | C6   | C7   | C8   | C9   | C10  |
|----------|------|------|------|------|------|------|------|------|------|------|
| 0.0952   | 0.0905| 0.0857| 0.0810| 0.0762| 0.0714| 0.0667| 0.0619| 0.0571| 0.0524|
| 0.0476   | 0.0429| 0.0381| 0.0333| 0.0286| 0.0238| 0.0190| 0.0143| 0.0095| 0.0048|
3. Result and Discussion
The following is a calculation process to determine which alternatives cause students to be lazy to study, here are the steps in the calculation process:

a. Data normalization.
Normalization is done by sharing the value of each criterion on the alternative with the number of criteria per each alternative. Normalization of matrix values can be done as follows:

\[
\begin{align*}
    r_{11} &= \frac{3}{\sqrt{(3)^2 + (2.15)^2 + (2.6)^2 + (2)^2}} = 0.1632 \\
    \vdots \\
    r_{120} &= \frac{2}{\sqrt{(2)^2 + (2.25)^2 + (3)^2 + (2)^2}} = 0.0997
\end{align*}
\]
So the results of the normalization matrix can be seen in Table 3 below:

| No | Alternative | c1   | c2   | c3   | c4   | c5   | c6   | c7   | c8   | c9   | c10  |
|----|-------------|------|------|------|------|------|------|------|------|------|------|
| 1  | A1          | 0.1632 | 0.1244 | 0.1142 | 0.1043 | 0.1538 | 0.1807 | 0.1152 | 0.1109 | 0.1273 | 0.1028 |
| 2  | A2          | 0.1170 | 0.0638 | 0.1142 | 0.0870 | 0.1134 | 0.0964 | 0.0845 | 0.0979 | 0.0849 | 0.0954 |
| 3  | A3          | 0.1414 | 0.1213 | 0.1077 | 0.1192 | 0.1134 | 0.1446 | 0.0921 | 0.1044 | 0.1273 | 0.1154 |
| 4  | A4          | 0.1088 | 0.0957 | 0.0653 | 0.0894 | 0.0749 | 0.0964 | 0.1075 | 0.0522 | 0.1167 | 0.0587 |

b. Weighting on the normalized matrix.
Weighting on the normalized matrix can be done by means of the weight value multiplied by the matrix value, the weighting of the matrix can be done as follows:

\[
V_{11} = 0.0952 \times 0.1632 = 0.0155 \\
\vdots \\
V_{120} = 0.0048 \times 0.0997 = 0.0005
\]
So that the results of weighting in the normalized matrix can be seen in Table 4 below:

| No | Alternative | c1  | c2  | c3  | c4  | c5  | c6  | c7  | c8  | c9  | c10 |
|----|-------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1  | A1          | 0.0155 | 0.0113 | 0.0098 | 0.0084 | 0.0117 | 0.0129 | 0.0077 | 0.0069 | 0.0073 | 0.0054 |
| 2  | A2          | 0.0111 | 0.0058 | 0.0098 | 0.0054 | 0.0088 | 0.0069 | 0.0056 | 0.0061 | 0.0049 | 0.0050 |
| 3  | A3          | 0.0135 | 0.0110 | 0.0092 | 0.0096 | 0.0088 | 0.0103 | 0.0061 | 0.0065 | 0.0073 | 0.0062 |
| 4  | A4          | 0.0104 | 0.0087 | 0.0056 | 0.0072 | 0.0059 | 0.0069 | 0.0072 | 0.0032 | 0.0067 | 0.0031 |

c. Determines the concordance and discordance index set.
1) Concordance Association
The concordance set can be searched by comparing comparative alternatives with alternatives compared to which alternative comparators must be greater than the alternatives compared. So that the concordance set in Table 5 is obtained.

| Concordance | A1   | A2   | A3   | A4   | A5   | A6   | A7   | A8   | A9   | A10  |
|-------------|------|------|------|------|------|------|------|------|------|------|
| A1          | -    | 1.2,3,4,5,6,7,8,9,10,11,12,13,14 | 1.2,3,5,6,7,8,9,10,11,12,14,15,16,1 | 1.2,3,4,5,6,7,8,9,10,11,12,14,15,16,1 |

1.2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,1
2) Set of Discordance
The concordance set can be searched by comparing the comparative alternatives with the alternatives compared which alternative comparators must be smaller than the alternatives compared. So that the concordance set in table 6 is obtained.

| Discordance | A1 | A2 | A3 | A4 |
|-------------|----|----|----|----|
| A1          | 3.11,13,15,18,19,20 | 9,12,16,17 | 1.3,5,6,8,10,11,12,14,15,17,18,20 |
| A2          | 1.2,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,20 | - | 1.2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18,20 |
| A3          | 11,13,18,19,20 | 2.4,6,7,9,11,13,18,19,20 | 7,19 | - |

d. Calculates concordance and discordance matrices.
1) Calculate concordance
Determining the value of the concordance matrix element is by summing the weights included in the concordance subset, the results of the concordance matrix can be seen in table 7, as follows:

| Discordance | A1 | A2 | A3 | A4 |
|-------------|----|----|----|----|
| A1          | -  | 3.11,13,15,18,19,20 | 4.9,10,11,13,14,15,18,19,20 | 11,13,18,19,20 |
| A2          | 1.2,3,4,5,6,7,8,9,10,11,12,13,14,16,17,18,20 | - | 1.2,4,5,6,7,8,9,10,11,12,14,15,16,17,18,20 |
| A3          | 1.2,3,5,6,7,8,9,12,16,17 | 3.5,12 | - | 2.4,6,7,9,11,13,18,19,20 |
| A4          | 1.2,3,4,5,6,7,8,9,10,11,12,14,15,16,17,18,20 | 1.3,5,6,8,10,11,12,14,15,16,17,18,20 | 1.2,3,4,5,6,8,9,10,11,12,13,14,15,16,17,18,20 | - |

2) Calculate discordance.
Determination of the value of the discordance matrix is to divide the maximum difference in the value of the criteria included in the discordance subset with the maximum difference in the value of all existing criteria. The results of the discordance matrix can be seen in table 8, as follows:

| Discordance | A1 | A2 | A3 | A4 |
|-------------|----|----|----|----|
| A1          | -  | 0.1 | 0.7 | 1 |
| A2          | 1  | -  | 0.2 | 0.7 |
| A3          | 0.4 | 0.9 | -  | 0.9 |
| A4          | 0.1 | 0.5 | 0.1 | -  |

e. Determine the dominant matrix of concordance and discordance.
1) Concordance dominant matrix
The results of the dominant matrix concordance can be seen in table 9, as follows:

| No | 1   | 2   | 3   |
|----|-----|-----|-----|
|    | A1  | A2  | A3  |
| 1  | -   | 1   | 1   |
| 2  | 0   | -   | 0   |
| 3  | 0   | 1   | -   |
| 4  | 0   | 0   | 0   |

2) Discordance dominant matrix
The results of the discordance dominant matrix can be seen in table 10, as follows:
Tabel 10. Concordance dominant matrix

| No | Discordance Dominant Matrix (g) | A1 | A2 | A3 | A4 |
|----|---------------------------------|----|----|----|----|
| 1  | A1                              | -  | 1  | 0  | 1  |
| 2  | A2                              |  0| -  | 0  | 1  |
| 3  | A3                              |  0| 1  | -  | 1  |
| 4  | A4                              |  0| 0  | 0  | -  |

f. Calculate pure concordance index and pure discordance
1) Calculate pure concordance index
To find the value of pure concordance can be seen in equation (9).
\[
C_1 = 0.9619 + 0.6905 + 0.9524 - (0.2619 + 0.3667 + 0.1190) = 1.8571
\]
\[
C_4 = 0.1190 + 0.4810 + 0.0762 -(0.9524+0.6571+0.9238) = -1.8571
\]

2) Calculate pure discordance index
To find pure discordance values can be seen in equation (10).
\[
D_1 = 0.1292 + 1+ 0.1888 - (1 + 1+ 1) = -2
\]
\[
D_4 = 1 + 1 + 1 - (0.1888 + 0.6880 + 0.2618) = 1.8614
\]
The next stage is to determine the best alternative by finding the average value of both pure concordance index and pure discordance. The best ranking can be seen in table 11 below:

Tabel 11. Best alternative calculation

| No | Factor                  | Pure Concordance | Ranking | Pure Discordance | Rank | Average | Final Rank |
|----|-------------------------|------------------|---------|------------------|------|---------|------------|
| 1  | Body condition          | 1.8571           | 1       | -                | 1    | 1       | 1          |
| 2  | Less in Learning Motivation | -1.1905      | 3       | 1.3731           | 3    | 3       | 3          |
| 3  | lecturer influence      | 1.1905           | 2       | -1.6935          | 2    | 2       | 2          |
| 4  | Environment             | -1.8571          | 4       | 1.8614           | 4    | 4       | 4          |

Based on the results of the calculation of the best alternative, the cause of lazy college students is the condition of the body (A1) with a pure concordance value of 1.8571 and a pure discordance value of -2.

4. Conclusion
The results of the study concluded that it had been ranked from the classification of factors causing lazy students to study at STIKOM Tunas Bangsa. There are four alternatives used in this study, namely body condition, lack of learning motivation, the influence of lecturers and the environment. From the results of the study obtained the condition of the body to be the first rank of the factors causing lazy students to study. It is expected that with the Electre II system can contribute to universities in improving the teaching and learning process in STIKOM Tunas Bangsa Pematangsiantar objectively.

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