

Visualization of Lecturer Teaching Evaluation Data Using K-Means Clustering and Tableau Methods

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Abstract

In the process, the results of monitoring and evaluating lecturers in each semester are usually only presented in the form of tables and descriptive explanations, but have not yet visualized the data for further analysis. The purpose of this study is to visualize the results of lecturer teaching evaluation using the *K-Means Clustering* and *Tableau* algorithms, and is expected to help the faculty and university monitor and evaluate lecturers in each semester in a more objective and informative manner. The results of the study found that the k-means clustering algorithm succeeded in finding the pattern of student clustering on the evaluation of lecturer teaching and based on the visualization of the results of k-means with a *tableau* it was found that most students gave a positive response to lecturer teaching and only a small number of students gave a poor assessment of lecturer teaching by emphasizing on improving the teaching process, namely consistently carrying out RPS, punctuality and so on

Keywords: Visualization, Data, Lecturers, K-Means Clustering, Tableau

1. Introduction

The quality of higher education is determined by the quality of lecturers' teaching[1]. Where a lecturer is required to have competence in his field [2]. By using various teaching techniques, lecturers must be able to convey material well adapted to the applicable study program curriculum and must also be supported by effective learning media. In addition, lecturers need to create a conducive teaching and learning atmosphere by building positive interactions with students[3].

The monitoring and evaluation process continues to be carried out on lecturer performance through student assessments at the study program level which are carried out at the end of the semester. In the process, the results of monitoring and evaluating lecturer teaching each semester are usually only presented in the form of tables and descriptive explanations, but have not yet visualized the data for further analysis. If you look at it, student assessments of lecturer teaching have a variety of important information, which can be used to find patterns of grouping lecturers based on the quality of their teaching. With large and complex data, it requires a proper analysis, or it will only become an archive without providing information in improving the quality of teaching.

Lecturer evaluation data in more depth is analyzed with the K-Means Clustering algorithm as one of the data mining approaches, where this algorithm is able to group data based on certain characteristics [4] The grouping of lecturers is carried out into several categories of teaching quality, for example: very good, good, adequate, and needs to be coached. With this grouping, it can be easier to determine strategies for coaching and improving lecturer competencies in a more targeted manner. Furthermore, to facilitate the data visualization process so that it is easier to understand using *tableau data visualization* software[5].

In this study, it combines the K-Means Clustering and Tableau algorithms which will produce a more objective and interactive visualization of lecturer teaching evaluation data. Where lecturer groups are displayed based on their performance and teaching quality such as mastery and how lecturers deliver material, lecturer discipline, and how lecturers interact with students.

Based on this background, this study intends to display data visualization from the results of lecturer teaching evaluation based on student assessments using *K-Means Clustering* and *Tableau* algorithms, and it is hoped that this study can help monitor and evaluate lecturer performance in each semester more objectively. Based on this background, the problem can be formulated, namely how to group lecturer performance based on lecturer teaching evaluation data by students with K-Means Clustering and visualize these results using *tableau*. It can be an analytical tool to conduct a more objective and informative evaluation for the development of the quality of lecturer teaching performance. The urgency of this research is because monitoring and evaluation carried out every semester is important to improve the quality of education in higher education, where the results of visualization of lecturer teaching evaluation data by students, can help leaders within the scope of faculties or quality assurance units (UJM) to be able to provide more informative data, besides that this is also a form of digital transformation in the field of education.

2. Literature Review

2.1. Previous Research

The following are some previous studies that support this research: Research [2] regarding lecturer performance has been proven to increase student achievement. The research [6] identified patterns of student satisfaction with the learning process using the K-Means Clustering algorithm. In addition, research [7] proves that the K-Means clustering algorithm has the ability to handle multivariable data and provide strategic information for decision-makers.

In addition, for research that focuses on interactive data visualization, namely research [8] that applies Tableau for data management of the Cirebon Regency Government, while research uses Tableau to design an interactive dashboard on agricultural production data in Majalengka Regency [9]. Then the research [10] used the k-means clustering algorithm with data visualization to map the career choices of vocational school graduates. The results show that a combination of cluster analysis and interactive visualization is able to produce adaptive information.

2.2 State Of The Art and Novelty

Based on some previous studies that have been explained, it can be concluded that the application of *k-means clustering* and tableau algorithms has been widely applied in other studies but only focuses on one of the two methods. Meanwhile, this study tries to combine both methods of *k-means clustering* and tableau for lecturer teaching evaluation. Based on this, the novelty of this research lies in the development of a model for visualization of lecturer teaching evaluation data based on K-Means, Clustering and Tableau for teaching evaluation analysis not only descriptively but also visually.

3. Research Methods

This study uses a descriptive quantitative approach that not only focuses on data presentation, but also on grouping, interpretation, and visualization of lecturer teaching evaluation patterns based on the results of student assessments presented with tableau. Where the development of an analysis model that is able to show the performance of lecturers more clearly.

3.1 Research Location

The research was conducted at the Faculty of Computer Science, Indonesian Christian University of Maluku (UKIM) in the information systems and informatics study program, by taking data from the evaluation of lecturer teaching by students. Data collection and analysis will be carried out during the November 2025 period. The sources and types of data for this research consist of quantitative data in the form of student assessment scores on the lecturer's teaching aspects and qualitative in the form of student suggestions or comments related to the learning process. Data collection was carried out through the distribution of questionnaires to students of the information systems study program and informatics study program of the Faculty of Computer Science, Indonesian Christian University of Maluku.

3.2 Research Stages

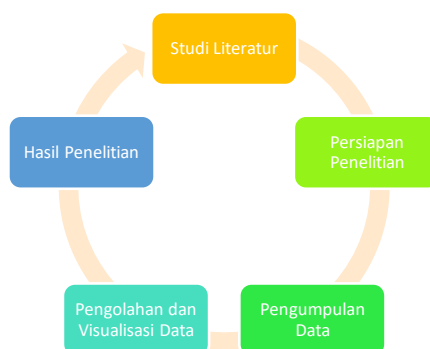


Fig. 1: Research Stages

Based on the picture 1 of the research stages, it can be seen that the research process starts from the literature study stage, namely studying and collecting information about the quality of teaching. After obtaining the necessary literature, the research team conducted the research preparation stage, where they collected materials and tools used during the research process. After that, the next step is to collect research data by distributing research questionnaires to students based on study program monitoring evaluation instruments targeted at more than 100 respondents. Respondents were obtained from students of the Faculty of Computer Science, informatics and information systems study program through purposive sampling which was the result of student evaluation of lecturers in general.

After the data is collected, the next step is to apply the K-Means Clustering algorithm for the grouping of lecturer data is very good, good and needs improvement. Here are some of the stages of the k-means clustering algorithm as shown in Figure 2.

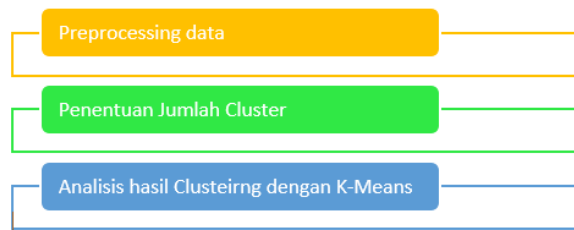


Fig.2: Stages of K-Means Clustering

In the Data Preprocessing stage, data normalization and keyword extraction from student comments are carried out. Furthermore, the determination of the number of clusters of optimal k scores is determined using *the Elbow* or *Silhouette Score* method, so that the lecturer group is formed representatively based on the student assessment pattern, then The data that is ready to be analyzed uses *the K-Means* algorithm to group lecturers into several clusters based on the similarity of assessment characteristics as shown in figure 3.

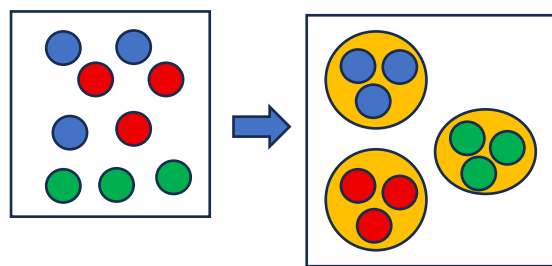


Fig.3: Grouping Patterns with K-Means

Then after the *clustering process*, the results of the quantitative grouping are combined with qualitative data (student comments), to find out the lecturers in the cluster who received comments on the teaching method. Changes in lecturer performance are visualized in the form of *trend lines* or *progress indicators* in Tableau. The final results are visualized using Tableau to display the results of clustering, comparison of performance between lecturers or study programs, and performance developments over time.

4. Results And Discussion

4.1 Data Collection

Collection of lecturer evaluation data by students through an online questionnaire filled out by students of the information systems study program and informatics study program during the odd semester of 2025/2026 with a total of 205 respondents who responded to 23 lecturers with 10 multiple-choice questions and 3 fills.

4.2 Data Preprocessing

At the data preprocessing stage, data tabulation is first carried out as a result of filling out a lecturer teaching evaluation questionnaire adjusted to the indicators of each Q1-Q10 question. The first indicator is the semester learning plan (Q1), consistency of RPS implementation (Q2), learning process (Q3), material explanation (Q4), benefits of assignments for students' abilities (Q5), assignment evaluation (Q6), material up-to-date (Q7), learning timeliness (Q8), student learning interest (Q9), and assessment transparency (Q10). As for filling out the essay, it can be known what you like during the learning process, the expectations of students in the future and suggestions for the teaching lecturer and the learning process as shown in figure 4.

Nama Mahasiswa	Nama Dosen	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Hal yang disukai	Harapan mahasiswa	Saran untuk Dosen Pengampu
M1	D1	3	3	3	3	4	3	3	3	3	3	Materi mudah di pahami	Saya berharap proses pembelajaran p; Semoga dosen pengampu dapat kons	Semoga dosen pengampu dapat kons
M2	D1	2	1	1	1	2	1	2	1	2	2			
M3	D2	2	1	1	1	2	1	2	1	2	2	materi perkuliahan	Pembelajaran harus ditingkatkan dan j. jika dosen ada halangan harap di beri	Semoga dosen pengampu dapat kons
M4	D2	3	4	2	4	4	2	3	3	3	4			
M5	D2	3	4	2	4	4	2	3	3	3	4	Materi	Proses belajar lebih baik lagi	Supaya ibu lebih baik lagi dalam meny
M6	D2	4	4	4	4	4	4	4	4	4	4			
M7	D2	3	3	3	3	4	3	3	3	3	3	Yang paling saya sukai dari perkuliahan	Saya harap pembelajaran di semester	Saran Saya dosen dapat menambah v
M8	D2	3	4	1	3	3	4	3	3	3	3			
M9	D2	2	1	1	1	2	1	2	1	2	2	Materi yang mudah dipahami	Semoga Materi-materi di semester beri	Saya harap dosen dapat lebih konsist
M10	D3	3	3	1	2	3	1	1	2	3	4			
												Presentasi	Lebih baik lagi	tetap semangat dalam mengajar kami

Fig.4: Tabulation of Student Assessment Data for Lecturers

After tabulating the data, the next step is the data normalization stage using *min-max normalization* to ensure that each indicator helps produce more accurate results, where the scale is between 0 to 1 [11]. Data normalization on the Q1-Q10 indicator which has a value range of 1-4, normalized in the range of 0-1 with *min-max scaling* as shown in figure 5.

Nama Mahasiswa	Nama Dosen	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
M1	D1	0.666667	0.666667	0.666667	0.666667	1	0.666667	0.666667	0.666667	0.5	0.5
M2	D1	0.333333	0	0	0	0	0	0.333333	0	0	0
M3	D2	0.333333	0	0	0	0	0	0.333333	0	0	0
M4	D2	0.666667	1	0.333333	1	1	0.333333	0.666667	0.666667	0.5	1
M5	D2	0.666667	1	0.333333	1	1	0.333333	0.666667	0.666667	0.5	1
M6	D2	1	1	1	1	1	1	1	1	1	1
M7	D2	0.666667	0.666667	0.666667	0.666667	1	0.666667	0.666667	0.666667	0.5	0.5
M8	D2	0.666667	1	0	0.666667	0.5	1	0.666667	0.666667	0.5	0.5
M9	D2	0.333333	0	0	0	0	0	0.333333	0	0	0
M10	D3	0.666667	0.666667	0	0.333333	0.5	0	0	0.333333	0.5	1

Fig.5: Data Normalization Results

4.3 Determination of Cluster Numbers

After the data normalization process using *min-max scaling*, the next step is to determine the number of clusters using *the silhouette coefficient* method which is the most commonly used method for determining the number of clusters in the data mining process, where the larger the Silhouette coefficient, the better the cluster [12]. The following are the results of clustering using *the silhouette* method such as figure 6 and table 1.

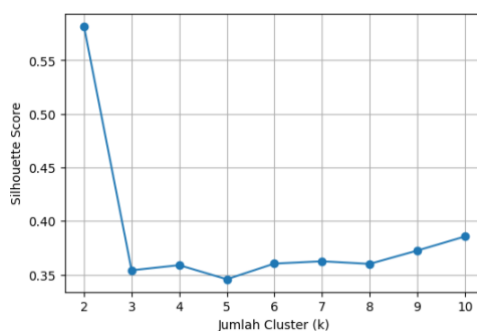


Fig.6: Cluster Determination Graph with the Silhouette Method

Based on Figure 6 of the cluster determination graph using the silhouette method, it can be seen that There are 10 clusters with each number of clusters (k) = 2 being clusters the highest which is at the value of 0.5776 while k = 3 to k = 10 is in the range value 0.3. So that the determination of the optimal number of clusters is at k=2. The following are the results of the value of determining the number of clusters as shown in Table 1 and figure 7.

Table 1: Results of Number of Clusters by Silhouette Method

Clusters by Silhouette Method	
Cluster	Value
2	0,5776
3	0,3623
4	0,3256
5	0,3379
6	0,3379
7	0,3533
8	0,3505
9	0,3667
10	0,3798

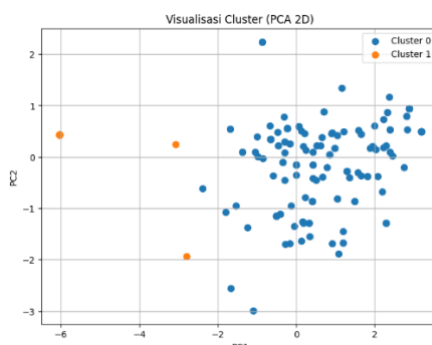


Fig. 7: Cluster Visualization

4.4 Clustering Results Analysis with KNN

From figure 7, the graph of cluster visualization results shows the pattern of distribution of teaching evaluation data (Q1–Q10), where cluster 0 is colored in blue and cluster 1 in orange. It can be seen that the largest number of students is in cluster 0 which totals 179 students and cluster 1 which totals 26 students. It can be seen that in cluster 0, most of the distribution patterns show dominant results, namely students mostly give the same assessment of lecturers' teaching patterns based on Q1–Q10 question indicators regarding RPS, consistency of implementation, learning process, material explanation, benefits of assignments, task evaluation, punctuality, and assessment transparency. While cluster 1 has an uneven distribution pattern because it spreads to the left side and is very small in number. Students in this cluster have different answer patterns based on experience or perception during the learning process, namely there may be students who think that the learning is not in accordance with the initial plan according to the explanation of the rps, or the delivery of material is not clear or can be very satisfied with the lecturer's teaching process so that the score is far above the average, and so on.

Table 2: Cluster Average Values

Cluster	Indicator									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
0	0,78	0,84	0,61	0,77	0,75	0,82	0,73	0,84	0,70	0,81
1	0,35	0,04	0,01	0,026	0,04	0,01	0,32	0,03	0,04	0,06

Based on table 2, it can be seen that cluster 0 has a high score in all indicators when compared to cluster 1, this means that students have a positive assessment of lecturer teaching, while cluster 1 is the opposite where it has a score that tends to be low, especially in the indicators of consistency in the implementation of RPS (Q2), learning process (Q3), material explanation (Q4), benefits of assignments for students' abilities (Q5), task evaluation (Q6). From this comparison, it can be seen that in cluster 0 they feel that the semester learning plan can be carried out well while in cluster 1 it is not so, according to cluster 1 lecturers are not consistent in carrying out the rps well, the learning process is not good, the explanation of the material is not clear, students in this cluster feel that the assignment is not delivered properly, and so on.

The analysis is based on what students like during the learning process, the expectations and suggestions are as follows: Students in cluster 0 prefer discussions during learning, then argue that the material presented is quite clear, while the expectations of students in cluster 0 are that future learning will be better and still enthusiastic for lecturers in providing teaching. So from these various comments, it can be concluded that students are satisfied with the lecturer's teaching.

While in cluster 1 students complained about too much theory and lack of practice, learning tends to be boring, students in this cluster want the teaching method to be improved. Students assessed the lack of transparency in assessment. So from this it can be concluded that students tend to feel that learning is ineffective and there are still many aspects that need to be improved in the future.

4.5 Data Visualization with Tableau

The results of the k-means clustering analysis were then implemented with Tableau. Tableau is a platform that is able to integrate data from various sources, one of which is a spreadsheet for data visualization, where the goal is to help understand data [13][14]. In this study, the results of lecturer performance visualization were assessed based on teaching evaluation data by students using *the tableau desktop public edition*, where the visualization picture can be seen from the distribution of clusters 0 and 1, student suggestions and lecturer performance based on Q1–Q10 indicators summarized in the tableau dashboard in figure 8.

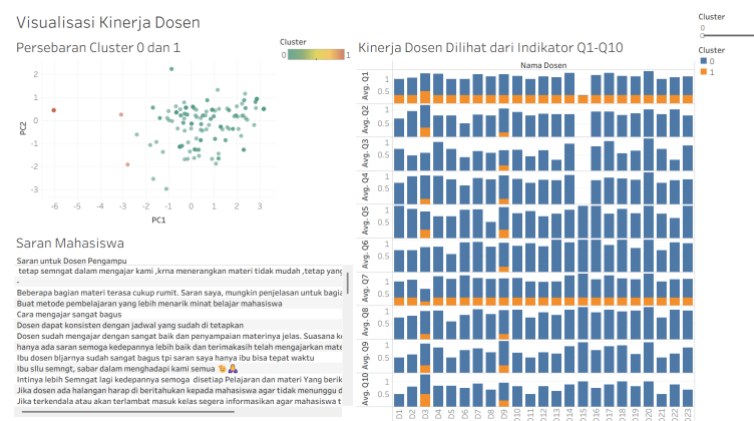


Fig.8: Lecturer Performance Visualization Dashboard

Based on the visualization dashboard of lecturer performance in figure 8, it can be seen that from the results of the analysis carried out based on the data of lecturer teaching evaluation by students with the grouping of students into cluster 0 and cluster 1. Where the graph of PC (Principal Components) 1 and 2 shows the distribution of student clusters with cluster 0 which is green and cluster 1 which is pink, showing a relatively high and low distribution pattern. Meanwhile, in the overview of lecturer performance based on Q1–Q10 indicators, it displays a graph for each lecturer based on the average score of Q1–Q10 indicators. For the semester learning plan (Q1), consistency in the implementation of RPS (Q2), learning process (Q3), material explanation (Q4), the benefits of assignments for students' abilities (Q5), assignment evaluation (Q6), material up-to-date (Q7), learning timeliness (Q8), student learning interest (Q9), and assessment transparency (Q10), it can be seen that cluster 0 provides more assessments while cluster 1 is only partial. And for student suggestions to improve the

learning process, it was found that lecturers must be clearer in teaching, on time, have effective teaching methods, create a comfortable classroom atmosphere and provide more practice.

5. Conclusion

Based on the results of the study, it was found that the k-means clustering algorithm can be used to find the clustering pattern of students towards the evaluation of lecturer teaching and then the results of the analysis are presented using a tableau desktop public edition. Then from the visualization of the results, it was found that most students gave a positive response to the lecturer's teaching which was assessed from the semester learning plan, consistency of the implementation of the RPS, the learning process, the explanation of the material, the benefits of the assignment for students' abilities, the evaluation of the assignment, the novelty of the material, the timeliness of learning, the student's learning interest, and the transparency of the assessment. The average lecturer has a good assessment on these 10 indicators, but only a small number of students think that lecturers should improve the teaching process from several indicators such as lecturers who are not consistent in carrying out rps well, poor learning processes, unclear material explanations, and so on, this is accompanied by some student comments on suggestions about punctuality, effective teaching patterns, creating a comfortable classroom atmosphere and providing more practice. For future research, it is expected to increase the number of research respondents by more than 250 respondents things of your article.

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