PAPER NAME

Analysis of Senior High Schools Quality i n Banda Aceh Using Cluster and Corresp ondence Analysis.docx

WORD COUNT

5402 Words

CHARACTER COUNT

25460 Characters

PAGE COUNT

13 Pages

FILE SIZE

1.9MB

SUBMISSION DATE

Dec 29, 2022 8:08 PM GMT+7

REPORT DATE

Dec 29, 2022 8:09 PM GMT+7

14% Overall Similarity

The combined total of all matches, including overlapping sources, for each database.

- 12% Internet database
- Crossref database
- 10% Submitted Works database
- 10% Publications database
- Crossref Posted Content database

Excluded from Similarity Report

- Bibliographic material
- Cited material
- Quoted material
- Small Matches (Less then 8 words)

PARADIKMA JURNAL PENDIDIKAN MATEMATIKA
ISSN: 1978-8002 (Print)
ISSN: 2502-7204 (Online)

Analysis of Senior High Schools Quality in Banda Aceh Using Cluster and Correspondence Analysis

Yulia Zahara[1], Fitri Ayu Ningtiyas[2], Nurul Afni Sinaga[3], Rifaatul Mahmuzah[4], Hidayatsyah[5]

[1,2,3,4,5]Department of Mathematics Education, Universitas Malikussaleh, Indonesia
*Corresponding Author: yulia.zahra@unimal.ac.id

Article History:
Received : D-M-20XX
Revised : D-M-20XX
Accepted : D-M-20XX
Online : D-M-20XX

Keyword :
School test scores;
Teacher;
School conditions;
Correspondence analysis;
Cluster analysis;

ABSTRACT

The purpose of this research is to analyze the relationship between teachers and school conditions on school test scores. Correspondence and cluster analysis are the analytical methods used. For school conditions to be classified into 3 clusters, 4 clusters, and 5 clusters, cluster analysis is used. The variable is tested using the G test to determine the affect on school test scores. This study resulted in a variable that has an impact on school test scores, school conditions with a p-value < α, so a correspondence analysis plot was formed to show the correlation between school conditions and school test scores. Good school conditions will result in good school test scores. Meanwhile, a reasonably good school conditions will result in fairly good school test scores. The correlation of school test scores with teachers shows that good school test scores are resulted by teachers with very good quality. Fairly good school test scores are resulted by good and fairly good teachers. Meanwhile, poor school test scores are resulted by teachers with poor quality.

Keywords: School test scores, teacher, school conditions, correspondence analysis, and cluster analysis.

A. INTRODUCTION

Multiple variable analysis is a statistical technique that is able to analyze many individual characteristics variables. In multiple variable analysis, there are several analyzes including principal component analysis, cluster analysis, biplot analysis, discriminant analysis, correspondence analysis and others. This study uses correspondence analysis and cluster analysis. The multiple variable analysis used to classify the shape of the observations based on the distance or similarity of the shape is called cluster analysis. While the correspondence analysis is a multiple variable analysis that describes the correlation between several qualitative variables based on graphs and is applied to examine data from a contingency table.

Correspondence analysis and cluster analysis can be applied in all aspects, including the aspect of education. Education is the most important thing that plays a role in educating the life of the nation. Generally, the quality of education comes from the quality of schools. According to the chairman of the Banda Aceh MPD, the quality of schools in Banda Aceh is still not very good and has not met the goals set because the role of the school committee is still very dysfunctional.

To determine the quality of a school, there are several factors that can be seen including the condition of the school and the teachers. The condition of the school is the thing that must be improved in order to support high-quality education and attract students' interest. There are several things that must be paid attention to school conditions such as the school environment, building conditions, school accreditation, and the number of students at the school. Educators or better known as teachers are individuals who have a positive influence on students and have responsibility for the learning process in education.

Based on the previous descriptions, it will be analyzed the correlation of the school conditions and teachers towards school exam scores at SMAN, MAN and SMKN in Banda Aceh using correspondence analysis. The data are in the form of categorical and numerical, while the correspondence analysis uses categorical data. Through cluster analysis, categories of school conditions and teachers will be formed which will be used in the correspondence analysis. Cluster analysis is used to classify school conditions and teachers because cluster analysis can classify data with different measurement scales.

B. RESEARCH METHODS

a. Cluster Analysis

Cluster analysis is a double-changing technique that aims to classify objects according to similarity characteristics. Objects with a high degree of similarity will be in a group, while low characteristic similarity occurs between objects in one group and another group (Mattjik and Sumertajaya, 2011). Cluster analysis with hierarchical complete linkage method and two-step cluster analysis for the data clustering process will be used in this study.

1. Analyze the cluster with the hierarchical complete linkage method

Several distance measurements are found in cluster analysis, but the one that is more often used is the euclidean distance. The euclidean distance formula is

$$j_{x,y} = \sqrt{(x_1 - y_1)^2 + (x_2 - y_2)^2 + \cdots + (x_p - y_p)^2} \quad (1)$$

Please note that the complete-linkage and single linkage procedures are similar, but at each level, the distance (similarity) between groups is the distance (similarity) between the two elements, that is, the farthest. Therefore, Complete linkage guaranteed a maximum distance of all group items. The distance between groups (u,v) and w is :

$$J(u,v)w = maks(j_{uw}, j_{vw}) \quad (2)$$

(Johnson and Wichern, 2007).

2. Two-step cluster analysis

Two-step cluster analysis can be used to solve problems of different measurement scales, such as categorical and numerical. A distance between groups is defined as the distance between each change of the centroid vectors contained in a group. In the two-step cluster analysis method, the distance used is the Log-Likelihood distance. Such distances can be applied to both categorical and numerical variables. The Log-Likelihood distance is defined as follows:

$$\xi_i = -n_i \left(\sum_{j=1}^{p} \frac{1}{2} \log\left(\hat{\sigma}_{ij}^2 + \hat{\sigma}_j^2\right) - \sum_{j=1}^{q} \sum_{l=1}^{m_j} \hat{\pi}_{ijl} \log\left(\hat{\pi}_{ijl}\right) \right)$$

$$\xi_s = -n_s \left(\sum_{j=1}^{p} \frac{1}{2} \log\left(\hat{\sigma}_{sj}^2 + \hat{\sigma}_j^2\right) - \sum_{j=1}^{q} \sum_{l=1}^{m_j} \hat{\pi}_{sjl} \log\left(\hat{\pi}_{sjl}\right) \right)$$

$$\xi_{(i,s)} = -n_{(i,s)} \left(\sum_{j=1}^{p} \frac{1}{2} \log\left(\hat{\sigma}_{(i,s)j}^2 + \hat{\sigma}_j^2\right) - \sum_{j=1}^{q} \sum_{l=1}^{m_j} \hat{\pi}_{(i,s)jl} \log\left(\hat{\pi}_{(i,s)jl}\right) \right)$$

$$\hat{\pi}_{ijl} = \frac{N_{ijl}}{N_i} \quad (3)$$

with:

ξ_i = log-likelihood on cluster i
$\xi_{(i,s)}$ = log-likelihood on cluster i and s
$\hat{\sigma}_{ij}^2$ = the estimated variance of the j-th continuous variable on the cluster i
$\hat{\sigma}_j^2$ = the estimated variance of the j-th continuous variable on the overall data
N_{ijl} = the number of observation objects on cluster i, j-th category, l-th level
N_i = the number of observation objects on cluster i

Two-step classifying consists of the initial step and the optimal classifying. Forming a Clustering Feature Tree (CF Tree) is the first step in the initial classification. Then, the optimal classification is determined from the CF Tree results. A group is called optimal if the distance between objects is the closest and the distance between groups is the farthest (Bacher et al. 2004).

b. Correspondence Analysis

Correspondence analysis is a science that discusses the relationship between two or more qualitative variables, which is used for data exploration from a contingency table with a multivariate technique graphically (Mattjik and Sumertajaya, 2011). According to Anderson et al. (2014), correspondence analysis is a method of composition of perception maps based on categories from contingency tables.

c. G Test

The G test is one of the independent tests better known as the likelihood ratio test and follows the distribution of X^2. The equation used is as follows:

$$G = 2 \sum_i \sum_j O_{ij} \log\left(\frac{O_{ij}}{E_{ij}}\right) \quad (4)$$

with:
O_{ij} = frequency of observations
E_{ij} = frequency of expectations

The G test hypothesis is:
H_0 = Variable X has no noticeable affect on variable Y.
H_1 = Variable X has a noticeable affect on variable Y.

To determine whether the value of G is significant or not, it can be determined by comparing G-value with the value of $X^2_{(\alpha, df)}$. If G-value > $X^2_{(\alpha, df)}$, H_0 is rejected and if G-value < $X^2_{(\alpha, df)}$, H_0 cannot be rejected (Agresti, 2002).

C. RESULT AND DISCUSSION

a. School conditions

The research was conducted in the city of Banda Aceh. The objects studied were 24 high schools, consisting of 3 MAN, 16 SMAN and 5 SMKN. This type of research is quantitative approach. In this study, the grouping of school conditions was carried out using the two-step cluster analysis method and involving the variables X1 (building condition), X2 (ownership status), X3 (land area), X4 (building area), and X5 (number of students). Variables X1 and X2 are categorical variables and variables X3, X4 and X5 are numerical variables. School conditions are grouped into 3 clusters, 4 clusters, and 5 clusters.

Table 1. The results of grouping school conditions with 3 clusters

***Cluster* 1**	***Cluster* 2**	***Cluster* 3**
SMAN 5 Banda Aceh	SMAN 2 Banda Aceh	SMAN 1 Banda Aceh
SMAN 12 Banda Aceh	SMAN 3 Banda Aceh	SMAN 6 Banda Aceh
SMKN 1 Banda Aceh	SMAN 4 Banda Aceh	SMAN 9 Banda Aceh
SMKN 2 Banda Aceh	SMAN 7 Banda Aceh	SMAN 10 Fajar Harapan
SMKN 3 Banda Aceh	SMAN 8 Banda Aceh	SMAN 13 Banda Aceh
SMKN 5 Telkom Banda Aceh	SMAN 11 Banda Aceh	SMAN 14 Iskandar Muda
	MAN Model Banda Aceh	SMAN 15 Adidarma Banda Aceh
		SMAN 16 Banda Aceh
		SMKN 4 Banda Aceh
		MAN Rukoh Banda Aceh
		MAN 2 Banda Aceh

Table 1 shows the condition of schools with 3 clusters. Furthermore, determination of the category for each cluster in table 1 is determined based on the mean and median values in table 2 below.

Table 2. The mean and median values of school conditions with 3 clusters

Var	*Cluster* 1		*Cluster* 2		*Cluster* 3	
	Mean	**Med.**	**Mean**	**Med.**	**Mean**	**Med.**
X1	-	Good	-	Good	-	Good
X2	-	The Owner	-	The Owner	-	The Owner
X3	21413,17	-	8961,86	-	5720,82	-
X4	7025,70	-	3277,5	-	2680,73	-
X5	569,33	-	738,57	-	309,45	-

Based on table 2, it can be seen that cluster 1 is a cluster with good school conditions because it has a high mean value compared to other clusters in X3 and X4. Cluster 2 is a cluster with fairly good school conditions because it has a high mean value at X5. Cluster 3 is a cluster with poor school conditions because it has the lowest mean value compared to clusters 2 and 3. Furthermore, the following table 3 presents the results of grouping school conditions with 4 clusters.

Table 3. Results of classifying school conditions with 4 clusters

Cluster 1	*Cluster* 2	*Cluster* 3	*Cluster* 4
SMAN 5 Banda Aceh	SMAN 2 Banda Aceh	SMAN 1 Banda Aceh	SMAN 13 Banda Aceh
SMAN 12 Banda Aceh	SMAN 3 Banda Aceh	SMAN 6 Banda Aceh	SMAN 14 Iskandar Muda
SMKN 1 Banda Aceh	SMAN 4 Banda Aceh	SMAN 9 Banda Aceh	SMAN 15 Adidarma Banda Aceh
SMKN 2 Banda Aceh	SMAN 7 Banda Aceh	SMAN 10 Fajar Harapan	SMAN 16 Banda Aceh
SMKN 3 Banda Aceh	SMAN 8 Banda Aceh	SMAN 11 Banda Aceh	SMKN 4 Banda Aceh
SMKN 5 Telkom Banda Aceh	MAN Model Banda Aceh	MANRukoh Banda Aceh	
		MAN 2 Banda Aceh	

Table 3 presents the condition of schools with 4 clusters. Furthermore, the determination of the category for each cluster in table 3 is determined by the mean and median values in table 4.

Table 4. The mean and median values for the conditions of schools with 4 clusters

Var	*Cluster* 1		*Cluster* 2		*Cluster* 3		*Cluster* 4	
	Mean	**Med.**	**Mean**	**Med.**	**Mean**	**Med.**	**Mean**	**Med.**
X1	-	Good	-	Good	-	Good	-	Good
X2	-	The Owner	-	The Owner	-	The Owner	-	The Owner
X3	21413,17	-	9455,5	-	5092,14	-	6656,8	-
X4	7025,70	-	3470,08	-	2632,43	-	2636,6	-
X5	569,33	-	757,67	-	468,29	-	150	-

Based on table 4, it can be seen that cluster 1 is a cluster with very good school conditions because it has a high mean value compared to other clusters in X3 and X4. Cluster 2 is a cluster with good school conditions because it has a high mean value compared to other clusters at X5. Cluster 4 is a cluster with fairly good school conditions because it has a high mean value compared to cluster 3 at X3 and X4. Cluster 3 is a cluster with poor school conditions because it has the lowest mean value compared to other clusters. Furthermore, the following table 5 presents the results of grouping school conditions with 5 clusters.

Table 5. Results of classifying school conditions with 5 clusters

Cluster 1	*Cluster* 2	*Cluster* 3	*Cluster* 4	*Cluster* 5
SMAN 5 Banda Aceh	SMKN 2 Banda Aceh	SMAN 2 Banda Aceh	SMAN 1 Banda Aceh	SMAN 13 Banda Aceh
SMAN 12 Banda Aceh	SMKN 5 Telkom Banda Aceh	SMAN 3 Banda Aceh	SMAN 6 Banda Aceh	SMAN 14 Iskandar Muda
SMKN 1 Banda Aceh		SMAN 4 Banda Aceh	SMAN 9 Banda Aceh	SMAN 15 Adidarma Banda Aceh

Cluster 1	*Cluster* 2	*Cluster* 3	*Cluster* 4	*Cluster* 5
SMKN 5 Banda Aceh		SMAN 7 Banda Aceh	SMAN 10 Fajar Harapan	SMAN 16 Banda Aceh
		SMAN 8 Banda Aceh	SMAN 11 Banda Aceh	SMKN 4 Banda Aceh
		MAN Model Banda Aceh	MAN Rukoh Banda Aceh	
			MAN 2 Banda Aceh	

Table 5 above presents the condition of schools with 5 clusters. Furthermore, the determination of the category for each cluster in table 5 is determined by the mean and median values in the following table 6.

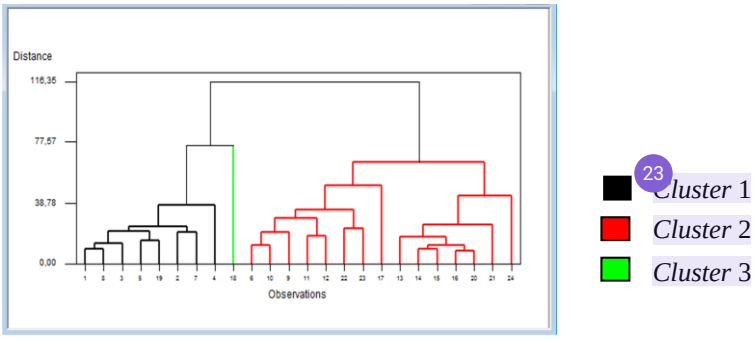
Table 6. The mean and median values of school conditions with 5 clusters

Var	*Cluster* 1		*Cluster* 2		*Cluster* 3		*Cluster* 4		*Cluster* 5	
	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.	Mean	Med.
X1	-	Good	-	Good	-	Good	-	Good	-	Good
X2	-	The Owner	-	Not Owner	-	The Owner	-	The Owner	-	The Owner
X3	17785,25		-28669		- 9455,5		- 5092,14		6656,8	-
X4	6787,55		- 7502		- 3470,08		- 2632,43		2636,6	-
X5	570		- 568		- 757,67		- 468,29		150	-

Based on table 6, it can be seen that cluster 2 is a cluster with very good school conditions because it has a high mean value compared to other clusters in X3 and X4. Cluster 1 is a cluster with good school conditions because it has a high mean value compared to clusters 3, 4 and 5 in X3 and X4. Cluster 3 is a cluster with fairly good school conditions because it has a high mean value compared to other clusters in X5. Cluster 5 is a cluster with poor school conditions because it has a higher mean value than cluster 4 in X3 and X5. Cluster 4 is a cluster with very poor school conditions because it has the lowest mean value compared to other clusters.

b. Teachers

The classifying teachers was carried out using the complete linkage cluster analysis method. There are 16 variables using to classifying teachers. X1 (the number of class III civil servant teachers), X2 (the number of class IV civil servant teachers), X3 (the number of honorary teachers), X4 (the number of contract teachers), X5 (the number of devoted teachers), X6 (the number of teachers with D3 educational background), X7 (the number of teachers with S1 educational background), X8 (the number of teachers with S2 educational background), X9 (the number of teachers with 0-4 years of experience), X10 (the number of teachers with 5-9 years of experience), X11 (the number of teachers with 10-14 years of experience), X12 (the number of teachers with 15-19 years of experience), X13 (the number of teachers with 20-24 years of experience), X14 (the number of teachers with 25-29 years of experience), X15 (the number of teachers with 30-34 years of experience), X16 (the number of teachers with 35-39 years of experience).



Picture 1. Dendogram of classifying teachers for 3 Clusters

The list of members for each cluster can be seen in Table 7 below.

Table 7. Results of classifying teachers with 3 clusters

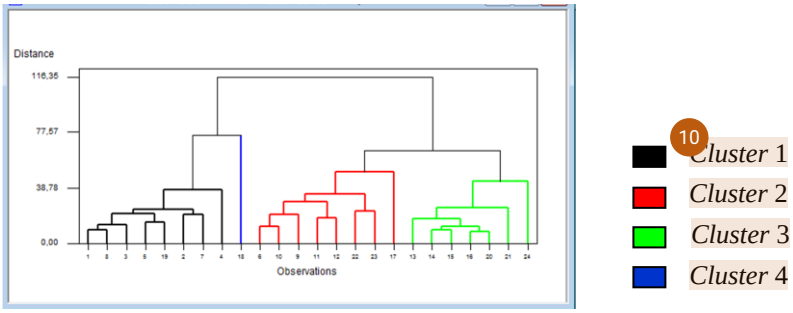
Cluster 1	*Cluster* 2	*Cluster* 3
SMAN 1 Banda Aceh	SMAN 6 Banda Aceh	SMKN 2 Banda Aceh
SMAN 2 Banda Aceh	SMAN 9 Banda Aceh	
SMAN 3 Banda Aceh	SMAN 10 Fajar Harapan	
SMAN 4 Banda Aceh	SMAN 11 Banda Aceh	
SMAN 5 Banda Aceh	SMAN 12 Banda Aceh	
SMAN 7 Banda Aceh	SMAN 13 Banda Aceh	
SMAN 8 Banda Aceh	SMAN 14 Iskandar Muda	
SMKN 3 Banda Aceh	SMAN 15 Adidarma Banda Aceh	
	SMAN 16 Banda Aceh	
	SMKN 1 Banda Aceh	
	SMKN 4 Banda Aceh	
	SMKN 5 Telkom Banda Aceh	
	MAN Model Banda Aceh	
	MAN Rukoh Banda Aceh	
	MAN 2 Banda Aceh	

The category for each cluster in table 7 is determined by the mean value. Mean value for each cluster can be seen in table 8 below.

Table 8. Mean Value of Teachers with 3 Clusters

Variable	*Cluster* 1		*Cluster* 2		*Cluster* 3	
	Mean	%	Mean	%	Mean	%
X1	16	25,35	16,43	43,64	54	49,54
X2	42,63	67,52	15,43	40,99	47	43,12
X3	4	6,34	2,86	7,59	8	7,34
X4	0,5	0,79	1	2,66	0	0
X5	0	0	1,93	5,12	0	0
X6	0,13	0,21	0,07	0,22	4	3,96
X7	55,5	94,47	28,93	90,81	94	93,07
X8	3,13	5,32	2,86	8,97	3	2,97
X9	0,13	0,21	0,64	2,022	35	34,65
X10	10,13	17,23	9,36	29,44	11	10,89
X11	7,63	12,98	8,29	26,07	11	10,89
X12	10,5	17,87	6,5	20,45	5	4,95
X13	8,25	14,04	2	6,29	24	23,76
X14	11,88	20,21	3,14	9,89	5	4,95
X15	8,25	14,04	1,57	4,94	9	8,91
X16	2	3,40	0,29	0,90	1	0,99

Based on Table 8. it can be seen that cluster 1 is a cluster with good teachers because it has a high mean percentage at X2, X7, X14, X15 and X16. Cluster 2 is a cluster with a fairly good teachers because it has a high mean percentage at X3, X4, X5, X8, X10, X11 and X12. Cluster 3 is a cluster with poor teachers because a high mean percentage is only found in X1, X6, X9 and X13.



Picture 2. Dendogram of classifying teacher for 4 Clusters

The list of members for each cluster can be seen in Table 9 below.

Table 9. The results of classifying teachers with 4 Clusters

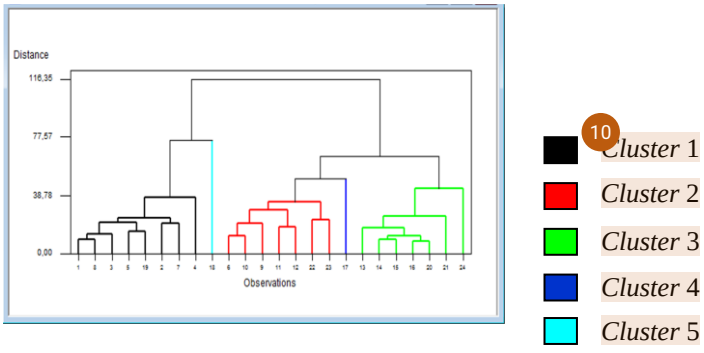
Cluster 1	*Cluster* 2	*Cluster* 3	*Cluster* 4
SMAN 1 Banda Aceh	SMAN 6 Banda Aceh	SMAN 13 Banda Aceh	SMKN 2 Banda Aceh
SMAN 2 Banda Aceh	SMAN 9 Banda Aceh	SMAN 14 Iskandar Muda	
SMAN 3 Banda Aceh	SMAN 10 Fajar Harapan	SMAN 15 Adidarma Banda Aceh	
SMAN 4 Banda Aceh	SMAN 11 Banda Aceh	SMAN 16 Banda Aceh	
SMAN 5 Banda Aceh	SMAN 12 Banda Aceh	SMKN 4 Banda Aceh	
SMAN 7 Banda Aceh	SMKN 1 Banda Aceh	SMKN 5 Telkom Banda Aceh	
SMAN 8 Banda Aceh	MAN Model Banda Aceh	MAN 2 Banda Aceh	
SMKN 3 Banda Aceh	MAN Rukoh Banda Aceh		

The mean value for each cluster can be seen in table 10 below.

Table 10. Mean Value of Teachers with 4 Clusters

Variable	*Cluster* 1		*Cluster* 2		*Cluster* 3		*Cluster* 4	
	Mean	%	Mean	%	Mean	%	Mean	%
X1	16	25,35	22,13	46,46	9,29	35,91	54	49,54
X2	42,63	67,52	21,13	44,36	10	38,67	47	43,12
X3	4	6,34	3,63	7,61	1,57	6,08	8	7,34
X4	0,5	0,79	0	0	2	7,73	0	0
X5	0	0	0,75	1,57	3	11,60	0	0
X6	0,13	0,21	0,13	0,29	0	0	4	3,96
X7	55,5	94,47	38,88	90,14	17,43	89,71	94	93,07
X8	3,13	5,32	4,13	9,57	2	10,29	3	2,97
X9	0,13	0,21	1	2,32	0,14	0,74	35	34,65
X10	10,13	17,23	11,88	27,54	5,14	26,47	11	10,89
X11	7,63	12,98	11,88	27,54	3	15,44	11	10,89
X12	10,5	17,87	9,75	22,61	1,86	9,56	5	4,95
X13	8,25	14,04	2,75	6,38	0,86	4,41	24	23,76
X14	11,88	20,21	3,75	8,70	2	10,29	5	4,95
X15	8,25	14,04	1,75	4,06	2	10,29	9	8,91
X16	2	3,40	0,38	0,87	4,29	22,06	1	0,99

Based on Table 10, it can be seen that cluster 1 is a cluster with very good teachers because it has a high mean percentage at X2, X7, X14 and X15. Cluster 2 is a cluster with good teachers because it has a high mean percentage at X3, X10, X11 and X12. Cluster 3 is a cluster with a fairly good teachers because it has a high mean percentage at X4, X5, X8 and X16. Cluster 4 is a cluster with poor teachers because the highest percentage is only found in X1, X6, X9 and X13. The results of classifying teachers with 5 clusters can be seen in picture 3 below.



Picture 3. Dendogram of classifying teacher for 5 Clusters

The list of members for each cluster can be seen in Table 11 below.

Table 11. The results of classifying Teachers with 5 Clusters

Cluster 1	*Cluster* 2	*Cluster* 3	*Cluster* 4	*Cluster* 5
SMAN 1 Banda Aceh	SMAN 6 Banda Aceh	SMAN 13 Banda Aceh	SMKN 1 Banda Aceh	SMKN 2 Banda Aceh
SMAN 2 Banda Aceh	SMAN 9 Banda Aceh	SMAN 14 Iskandar Muda		
SMAN 3 Banda Aceh	SMAN 10 Fajar Harapan	SMAN 15 Adidarma Banda Aceh		
SMAN 4 Banda Aceh	SMAN 11 Banda Aceh	SMAN 16 Banda Aceh		
SMAN 5 Banda Aceh	SMAN 12 Banda Aceh	SMKN 4 Banda Aceh		
SMAN 7 Banda Aceh	MAN Model Banda Aceh	SMKN 5 Telkom Banda Aceh		
SMAN 8 Banda Aceh	MAN Rukoh Banda Aceh	MAN 2 Banda Aceh		
SMKN 3 Banda Aceh				

Category for each cluster in table 11 is determined by the mean value. The mean value for each cluster can be seen in Table 12 below.

Table 12. Mean Value of Teachers with 5 Clusters

Variabel	*Cluster* 1	*Cluster* 2	*Cluster* 3	*Cluster* 4	*Cluster* 5
	Mean (%)	**Mean (%)**	**Mean (%)**	**Mean (%)**	**Mean (%)**
X1	25,35	41,98	35,91	71,93	49,54
X2	67,52	47,53	38,67	26,32	43,12
X3	6,34	8,64	6,08	1,75	7,34
X4	0,79	0	7,73	0	0
X5	0	1,85	11,60	0	0
X6	0,21	0	0	1,79	3,96
X7	94,64	89,27	89,71	94,47	93,07
X8	5,32	10,72	10,29	3,57	2,97
X9	0,21	2,42	0,74	1,79	34,65
X10	17,23	22,84	26,47	51,79	10,89
X11	12,98	31,142	15,44	8,93	10,89
X12	17,87	24,57	9,56	12,5	4,95
X13	14,04	6,23	4,41	7,14	23,76
X14	20,21	7,61	10,29	14,29	4,95
X15	14,04	4,50	10,29	1,79	8,91
X16	3,40	0,69	22,06	1,79	0,99

Based on Table 12, it can be seen that cluster 1 is a cluster with very good teachers because it has a high mean percentage at X2, X7, X14 and X15. Cluster 2 is a cluster with good teachers because it has a high mean percentage at X3, X8, X11 and X12. Cluster 3 is a cluster with fairly good teachers because it has a high mean percentage at X4, X5 and X16. Cluster 4 is a cluster with poor teachers because it has a high mean percentage at X1 and X10. Cluster 5 is a cluster with very poor teachers because a high mean percentage is only found in X6, X9 and X13.

c. Correspondence Analysis

Data from the condition of schools and teachers that have been grouped using cluster analysis will be re-analyzed and a two-way contingency table is formed. The following contingency table is formed below.

1. **Contingency table between school test scores and 3 cluster school conditions**

Tabel 13. Contingency Table between School Test Scores and 3 Cluster School Conditions

School Test Scores	School Condition		
	Good	Fairly Good	Poor
A	0	4	2
B	5	3	8
C	1	0	1

2. **Contingency table between school test scores and 4 cluster school conditions**

Tabel 14. Contingency Table between School Test Scores and 4 Cluster School Conditions

School Test Scores	School Condition			
	Very Good	Good	Fairly Good	Poor
A	0	3	0	3
B	5	3	4	4
C	1	0	1	0

3. **Contingency table between school test scores and 5 cluster school conditions**

Tabel 15. Contingency Table between School Test Scores and 5 Cluster School Conditions

School Test Scores	School Condition				
	Very Good	Good	Fairly Good	Poor	Very Poor
A	0	0	3	0	3
B	1	4	3	4	4
C	1	0	0	1	0

4. **Contingency table between school test scores and 3 cluster teachers**

Table 16. Contingency Table between School Test Scores and 3 Cluster School Conditions

School Test Scores	Teachers		
	Good	Fairly Good	Poor
A	4	2	0
B	4	12	0
C	0	1	1

5. **Contingency table between school test scores and 4 cluster teachers**

Table 17. Contingency Table between School Test Scores and 4 Cluster School Conditions

School Test Scores	Teachers			
	Very Good	Good	Fairly Good	Poor
A	4	2	0	0
B	4	6	6	0
C	0	0	1	1

6. **Contingency table between school test scores and 5 cluster teachers**

Table 18. Contingency Table between School Test Scores and 5 Cluster School Conditions

School Test Scores	Teachers				
	Very Good	Good	Fairly Good	Poor	Very Poor
A	4	2	0	0	0
B	4	5	6	1	0
C	0	0	1	0	1

d. G Test

The contingency table that has been formed aims to analyze the relationship between school conditions and teachers on school test scores using the G test. The test was carried out using SPSS software, with this following results.

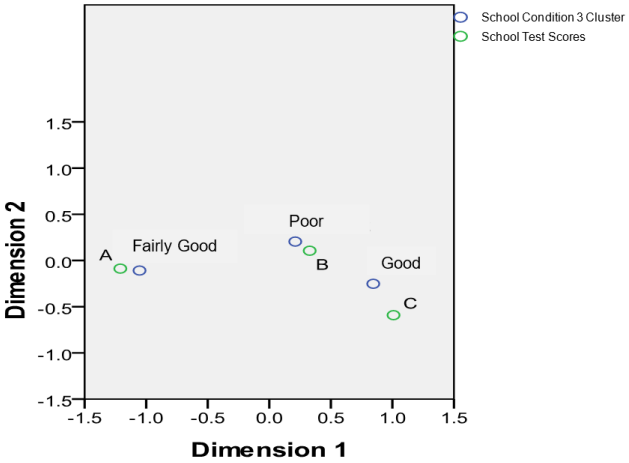
Table 19. Results of G Test

Variables that Affect School Test Scores	*P-Value*
School conditions with 3 clusters	0,096*
School conditions with 4 clusters	0,081*
School conditions with 5 clusters	0,085*
Teachers with 3 clusters	0,047**
Teachers with 4 clusters	0,033**
Teachers with 5 clusters	0,073*

Based on Table 18, it can be seen the relationship between the variables and the school test scores. Variables that have a p-value <α are school conditions and teachers with 3 clusters, 4 clusters and 5 clusters. Because the p-value < α then H_0 is rejected. Based on the results of the G test, there is a relationship between the variables and school test scores. So, it can be concluded that there is a relationship between teachers and school conditions on school test scores.

e. Plot of the Relationship between School Conditions and Teachers to School Test Scores

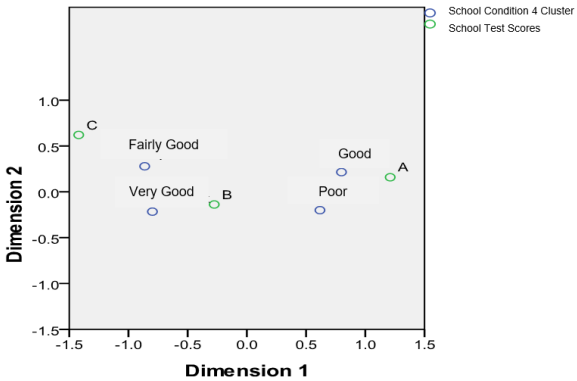
1. The relationship between school conditions with three clusters to school test scores



Picture 4. Plot of the relationship between school conditions with 3 clusters to school test scores

Based on Picture 4, it can be seen that the variable condition of good school is close to the school test score in category C. This shows that the condition of good school will result poor school test score. While school conditions that are fairly good will result good school test scores and poor school conditions will result fairly good school test scores.

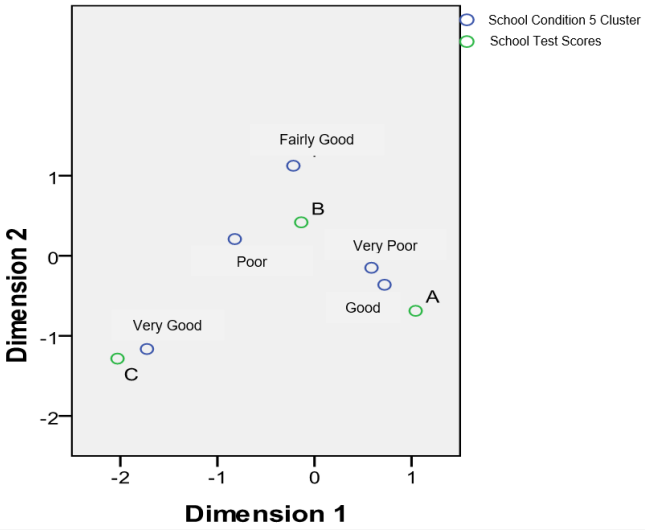
2. The relationship between school conditions with 3 clusters to school test scores



Picture 5. Plot of the relationship between school conditions with 4 clusters to school test scores

Based on Picture 5, it can be seen that the variable condition of very good schools is close to the school test score in category B. This shows that the very good school condition will result fairly good school test score. Good and fairly good school conditions will result good school test scores. While fairly good school conditions will result poor school test score.

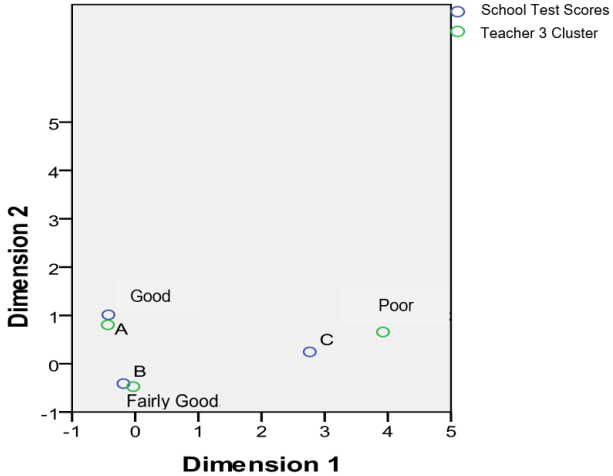
3. The relationship between school conditions with 5 clusters to school test scores



Picture 6. Plot of the relationship between school conditions with 5 clusters to school test scores

Based on Picture 6, it can be seen that the variable of school conditions which is very good is close to the school test scores in category C. This shows that the poor school test scores is resulted by very good school condition. Good school test score is resulted by good and very poor school conditions. Meanwhile, the school test scores which fairly good is resulted by the school conditions which fairly good and poor.

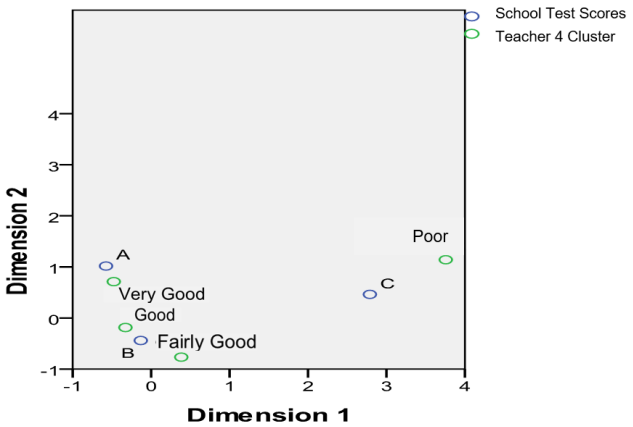
4. The relationship between teachers with three clusters to school test scores



Picture 7. Plot of the relationship between teachers with 3 clusters to school test scores

Based on Picture 7, it can be seen that the variable of good teachers is close to the school test scores in category A. This shows that good teachers will result good school test scores. While teachers who are fairly good will result fairly good school test scores and teachers who are poor will result poor school test scores.

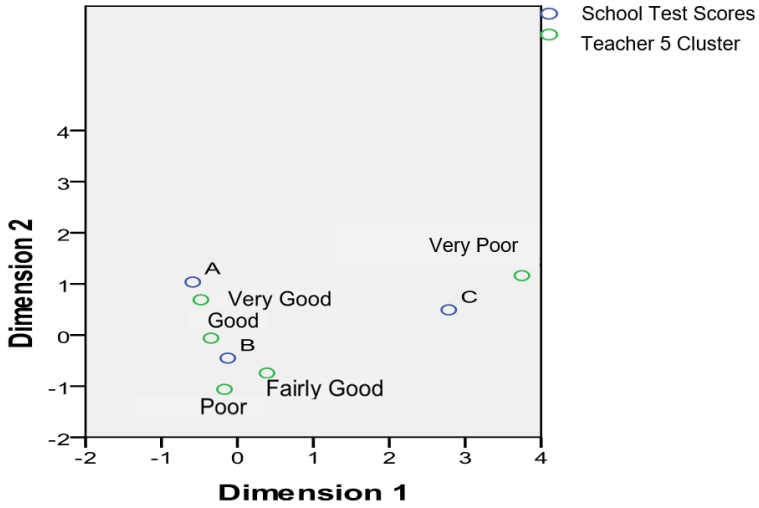
5. The relationship between teachers with four clusters to school test scores



Picture 8. Plot of the relationship between teachers with four clusters to school test scores

Based on Figure 8, it can be seen that very good teachers variable is close to school test scores in category A. This shows that teachers with very good quality will result good school test scores. Teachers with good and fairly good quality will result fairly good school test scores. However, poor quality teachers will result poor school test scores.

6. The relationship between teachers with five clusters to school test scores



Picture 9. Plot of the relationship between teachers with 5 clusters to school test scores

Based on Picture 9, it can be seen that the very good teachers is close to school test scores in category A. This shows that very good teachers will result good school test scores. For good, fairly good and poor will result fairly good school test score. Meanwhile, teachers who are very poor will result poor school test scores.

D. CONCLUSION AND SUGGESTIONS

Based on the review data regarding cluster and correspondence analysis carried out, it can be concluded that:

1. From the two variables tested, namely the condition of the school and teachers, the two variables influence on school test scores.
2. In the analysis of the relationship between school conditions and 3 clusters school test scores, it shows that a good school condition will result fairly good school test score. In the analysis of the relationship between school conditions and 3 clusters school test scores, it shows that good school condition will result good school test score.

3. In the analysis of the relationship between school conditions and 4 clusters school test scores, it shows that very good school conditions will result fairly good school test scores. Good and bad school conditions will result good school test scores. Good and bad school conditions will result good school test scores.
4. In the analysis of the relationship between school conditions and 5 clusters school test scores, it shows that very good school condition will result poor school test scores. Good and bad school conditions will result fairly good school test scores. Meanwhile, school conditions that are fairly good and very poor will result good school test scores.
5. In the analysis of the relationship between the teachers and 3 clusters school test scores, it shows that good teachers will result good school test scores. Meanwhile, fairly good teachers will result fairly good school test scores, and teachers with poor quality will result poor school test scores.
6. In the analysis of the relationship between teachers and 4 clusters school test scores, it shows that very good teachers will result good school test scores. For teachers who are good and fairly good will result fairly good school test scores. Meanwhile, teachers who are poor quality will result poor school test scores.
7. In the analysis of the relationship between the teachers and the 5 clusters school test scores, it shows that very good teachers will result good school test scores. For good teachers, fairly good and poor quality will result fairly good school test scores. Meanwhile, teachers who are very poor quality will result very poor school test scores.

ACKNOWLEDGEMENT

With all due respect all to my beloved friends involved and have helped a lot in completing the research and writing of this journal. So that all difficulties and obstacles can be overcome properly. I also express my gratitude to the Paradikma team of editors and reviewers who have helped publish this journal.

REFERENCES

Anderson, R. E., Babin, B. J., Black, W. C., and Hair, J. F. 2014. *Multivariate Data Analysis* 7th Edition. Pearson Education Limited, United States of America

Bacher, J., et al. 2004. *SPSS Twostep Cluster*. Universitat Erlangen-Nurnberg

Johnson, R.A. and Wichern, D.W. 2007. *Applied Multivariate Statistical Analysis* 6th Edition. Pearson Prentice Hall, United States of America.

Mattjik, A. A. dan Sumertajaya, I.M. 2011. *Sidik Peubah Ganda dengan Menggunakan SAS*. Departemen Statistika, Institut Pertanian Bogor.

Muthahharah, I. dan Juhari, A. 2021. Cluster Analysis with Complete Linkage and Ward's Method for Health Service Data in Makassar City. Vol. 4, No. 2, Hal. 109-116.

Sam, F.S., Wasono. dan Syaripuddin. 2021. Analisis Cluster Pada Produk Mie Instan Berdasarkan Komposisi Yang Terkandung Dengan Menggunakan Metode Ward. Jurnal Eksponensial, Vol. 12, No. 1: 53-58.

Sugiharto, A., Sari, B.N. dan Padilah, T.N. 2021. Analisis Cluster Sebaran Covid-19 Menggunakan Algoritma K-Means Clustering (Studi Kasus: Provinsi Jawa Barat. Journal of Information Technology and Computer Science (INTECOMS) Vol. 4, No. 2: 291-301.

Ulinnuh, N. dan Veriani, R. 2020. Analisis Cluster dalam Pengelompokan Provinsi di Indonesia Berdasarkan Variabel Penyakit Menular Menggunakan Metode Complete Linkage, Average Linkage dan Ward. Jurnal Nasional Informatika Dan Teknologi Jaringan, Vol. 5, No. 1.

14% Overall Similarity

Top sources found in the following databases:

- 12% Internet database
- Crossref database
- 10% Submitted Works database
- 10% Publications database
- Crossref Posted Content database

TOP SOURCES

The sources with the highest number of matches within the submission. Overlapping sources will not be displayed.

1	**vdocuments.mx** Internet	3%
2	**bandaacehkota.go.id** Internet	1%
3	**ebin.pub** Internet	1%
4	**online-journal.unja.ac.id** Internet	1%
5	**University of Leicester on 2019-08-25** Submitted works	<1%
6	**slideshare.net** Internet	<1%
7	**pdss.snmptn.ac.id** Internet	<1%
8	**journal.universitasbumigora.ac.id** Internet	<1%

9	psychologyandeducation.net Internet	<1%
10	text-id.123dok.com Internet	<1%
11	University of Southampton on 2006-10-03 Submitted works	<1%
12	The Chicago School of Professional Psychology on 2010-06-29 Submitted works	<1%
13	Syiah Kuala University on 2018-07-20 Submitted works	<1%
14	lib.dr.iastate.edu Internet	<1%
15	pdffox.com Internet	<1%
16	Universitas Muhammadiyah Sinjai on 2021-01-27 Submitted works	<1%
17	repositorio.comillas.edu Internet	<1%
18	econstor.eu Internet	<1%
19	Gerhard Wittig, Gavin Finnie. "Estimating software development effort ... Crossref	<1%
20	Universitas Islam Internasional Indonesi on 2022-02-24 Submitted works	<1%

21	documentserver.uhasselt.be Internet	<1%
22	ecoqua.ecologia.ufrgs.br Internet	<1%
23	Indian School of Business on 2022-12-17 Submitted works	<1%
24	Maria D. Fitzpatrick, Michael F. Lovenheim. "Early Retirement Incentive... Crossref	<1%
25	Nurhasanah, A Rusyana, A R Fitriana. "Binary logistic regression for ide... Crossref	<1%
26	eprints.bournemouth.ac.uk Internet	<1%
27	publisher.unimas.my Internet	<1%
28	arjhss.com Internet	<1%
29	LL DIKTI IX Turnitin Consortium Part II on 2020-10-14 Submitted works	<1%
30	Loughborough University on 2014-04-28 Submitted works	<1%
31	idoc.pub Internet	<1%
32	jcovm.uobaghdad.edu.iq Internet	<1%

33 repository.ar-raniry.ac.id

Internet

<1%