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Clustering in Education

Abdul Rahmat[1]

Abstract:

This study aims to find out every educational institution has a unique style of leadership and has a tendency of closeness with certain leadership indicators. The method used in this research is cluster analysis belonging to interdependent analytical technique and aims to mapping based on grouping of leadership variable in nonformal education in Gorontalo province 2017. This analysis is done by placing observation simultaneously to then do the calculation as reference Profiling characteristic descriptions of each cluster to explain the differences that occur in each indicator.

The researcher compiled a questionnaire in measuring the leadership type of multifactor leadership questionnaire. The standard deviation data results from each indicator are used in hierarchical and non-hierarchical cluster analysis. The results showed 1). These clusters of educational institutions have a transformational leadership model and emphasize the leaders' charism and especially the motivation of their members. 2). This cluster of educational institutions has a transactional leadership model but has a combination of transformational leadership characteristics, especially motivation.

This cluster can be called Transactional and Motivational, 3). These clusters can be interpreted as educational institutions that have a transformational leadership model but have a combination of transactional leadership characteristics, especially exceptions. These clusters can be called Transformational and Exceptions, 4). These clusters can be interpreted as educational institutions that have a transformational leadership model and emphasize the leader's charism and especially the intellectual stimulation of its members. This cluster can be called Transformational Intellectual and Charismatic.

Research suggestions that the transformational model or transactional model is the best model that can be used to achieve the best results in accordance with the conditions that exist in each unit of non-formal education.

Keywords: leadership model, and non-formal education unit

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I. Introduction

The era of globalization makes education as something simple but in it there is a complexity in the process of achieving learning objectives. Education not only plays a major role in the progress of the nation, but also relates to an increasingly competitive free market, education should be seen to accommodate the public for a country to have quality human beings (Dadhich and Bhal, 2008). Education is the most important thing in our lives, it means that every human being deserves and hopes to always develop in education. Education in general has a meaning of a life process in developing each individual to be able to live and live life. So being an educated person is very important. The first education we get in the family environment, school environment and community environment (Hakimi and Knippenberg, 2017). The emergence of nonformal education around the late 60s to early 70s as in his Philip Coombs and Manzoor (1985). The World Crisis In Education is caused by the need for education that is so widespread, especially in developing countries (Coombs and Ahmed, 1974). Law Number 20 Year 2003, Article 26, paragraph 1, describes non-formal education held for people who need educational services that serve as a substitute, enhancement and or complement of formal education in order to support lifelong education (Guskova *et al.*, 2016).

Paragraph 2 describes nonformal education functioning to develop the potential of learners with an emphasis on mastery of knowledge and functional skills as well as the development of professional attitude and personality. This education is considered able to provide educational activities that meet the needs and interests that can not be met by formal schools to be able to meet the global demands in the world of work (Hoeffler and Keller, 2013; Vovchenko *et al.*, 2017).

Figure 1. *Education Environment*
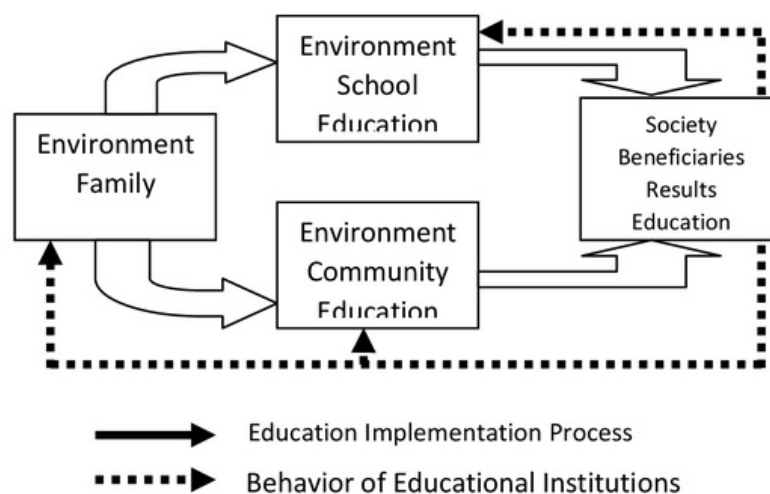
The mandate of the law automatically guarantees the existence of nonformal education as set forth in Articles 13 and 26. Article 13 contains formal, nonformal and informal educations complementary and enriching. While in article 26 set technical implementation. This article emphasizes the importance of non-formal education to enhance knowledge, skills, life skills, self-development, work and self-employment.

Mustafa Kamil (2009) outlines the various definitions of nonformal education presented by experts: According to Coombs, nonformal education is any activity organized outside the established school system whether it is done separately or partly from a wider range of activities, done deliberately To serve a particular student to achieve his learning goals. Non-formal education is every opportunity where there is regular, directional communication outside the school, and a person obtains information, knowledge and training and counseling according to his age and needs in order to develop the skill level, attitudes and values that make it possible for him to be an efficient participant And effective in the environment of his family and even his community and country (Jogulu, 2010). Nonformal education is the tact of knowledge, skills and attitudes aimed at and systematically (with emphasis on skill enhancement) outside of formal schooling education technology, with a mixed structure of time, place, resources and learning people but directed (Jung, 1995).

In the management of nonformal educational institutions, leadership is an important asset both in academic and non-academic activities (George and King, 1991; Davy, 1998; Neyland and Surridge, 2002; Merzuki and Latif 2009). In addition, information is also a vital element in the determination of plans, strategies and management policies (Locander, 2001; Szopa and Jalocha, 2014, Alesina, Alberto and Eliana La Ferrara, 2005). Therefore, a reliable and reliable leadership management system is required. However, in reality, optimal leadership, in the sense of efficient and effective, is not an easy thing to achieve, because it involves in general a complex system, coupled with a lack of human resources capable of mastering the technology used (Hamza, 2011). Non-formal education unit (Luanglath, 2014) is an organization that in the implementation of daily activities can not be separated from the role of a leader to memastikanterjajar educational process in accordance with the purpose of education so that the achievement of the desired educational program achievement. This function is related to the purpose of Indonesia to educate the nation's life and develop the potential of the learners.

Ricanty (2012) Richey (1974) to realize a good educational process, a professional educator should have a professional qualification and understand more than the concept of education but view education as a career in the development of common progress. And non-private is a public institution in which there is a leader role in running the organization.Totalitas characteristics of educators, especially related to leadership of course can be a solution as a solution in the process of maintenance and quality of educational institutions (Muenjohn, 2007; Yukl, 1989; Gorina, 2016).

Quality can be defined as a picture and a relative size of the relative goods or services that demonstrate its ability to meet, satisfy or exceed the expected or implied needs of its users (MoNE, 2002; Jener, 1995; Besterfield, 2009). Similar definitions are expressed by Feigenbaum (1991) and Heizer and Render (2006). Feigenbaum (1991) defines quality as a whole combination of product and service characteristics of marketing engineering, manufacturing and maintenance that make products and services used to meet customer expectations. Meanwhile, according to Heizer and Render (2006), quality / quality is the totality of form and characteristics of goods or services that menununjukkan kemmpuannya to satisfy the needs that appear clear or hidden.

Juran and Godfrey (1998) focus on the conception of quality / quality in terms of fitness for use, which has the meaning of ease in obtaining goods or services, safety and comfort in using and can meet the tastes and needs. Quality can also mean as a degree or level of certitude that is inherent in a product that satisfies the requirements or desires of the user (ISO 9000: 2000). Naor (2008) quality can be interpreted as a "meeting" between value, suitability, harmony or compatibility with a specification, standard, requirement, requirement or suitability of benefits of goods, products or services. Crosby (1983) defines quality as the conformity of an object, product, service or work with what is required or standardized. While Beeby (in Arend, 2007) views quality in terms of the process in terms of the effectiveness or accuracy and efficiency of the overall factors or elements that play a role in a process (Phinney, 1997; Sultanova and Chechina, 2016; Meskhi *et al.*, 2016).

Ambarita (2010) process and outcome are two important indicators of the quality of nonformal education. In the process of education, quality is influenced by various factors, among others: infrastructure facilities, raw data, information management methodology, management and administrative support, resource availability and organizational environment While quality indicators for information system results generally refer to achievement or performance achieved by Institutions in a certain period of time, for example in producing information products that are useful for various development activities in the organization (Rajput, 2012).

Campbell (1982) through his book Grammatical Man: Information Entrophy, Language and Life explains the relationship of management, information and decision making as follows: 1) Executive management, at this level information is required to conduct forecasts Long term and strategic decision making. (Vincent, 2001). 2) Medium management, at this level of management, information is used for the needs of tactical decision-making related to short-term activities and resource allocations (natural, human and financial / funding) in order to achieve predetermined targets (Marjuki, 2009). 3). Management of supervision, information needed for technical decision-making. Making these decisions is a process to ensure that specific tasks are implemented in an effective and efficient manner (Yueh Sian Lee, 2012).

The problem is that in the midst of tribal race in Indonesia, some types of leadership can run effectively or ineffectively. The cluster characteristic of leadership is useful to know how the pattern and mapping of leadership that exist in non-formal education units related. More explicitly Barth *et al.* (2014) explains that leadership roles, especially transformational leadership function as leverage in the process of organizational progress and bring change in organizations. Changes in the leadership model from transactional to transformational processes are what can guide an organization in navigating the flow of change and keeping commitment from every part of the organization to achieving common goals (Bass, 1990). The role of leaders in an organization has a major impact on the attitude or response of subordinates to the problems it faces (Dadhich and Bhal, 2008). Leadership clustering in non-formal education units is especially important in assessing a good leadership standard in an area and determining role models that can serve as an example for other Education Agencies (Rahmat and Widayati, 2016).

II. Research Methodology

The method used in this research is cluster analysis belonging to interdependent analytical technique and aims to mapping based on the grouping of leadership variable in non-formal education in Gorontalo province in 2017. Catell (1943) explains that cluster analysis has a useful function in See the characteristics of a personal characteristic, especially in relation to one's psychological processes. This analysis is done by placing observations simultaneously to then be calculated as a profiling reference of the characteristic characteristics of each cluster to explain the differences that occur in each indicator (Everitt and Brian, 2011).

Avolio (1995) developed a questionnaire in measuring the type of leadership called multifactor leadership questionnaire (MLQ) with measurements for transformational leadership as charisma, intellectual stimulation, and inspirational motivation. While in the measurement of transactional leadership can be used two indicators of contingent awards and exception management. MLQ concept is used as the main indicator in conducting profiling of leadership in educational institution. As a behavior-related study, the number of samples was based on Roscoe (1975) rule of thumb with a total sample of 35 educational institutions based on quota sampling techniques. Based on the data obtained, the standard deviation value is used for the processing of cluster analysis with the data attached in Table 1.

Table 1. Results Descriptive statistical process

	N	Minimum	Maximum	Mean	Std. Deviation
Charisma	35	55	91	74.83	9.841
Intellectual Stimulation	35	50	93	71.77	9.894
Motivation	35	50	95	71.63	13.463
Appreciation	35	52	89	70.54	12.652

Exception	35	55	90	72.57	9.397
Valid N (listwise)	35				

Based on the data processing, it is known that all data is successfully processed and is valid data, with a maximum value of 95 for motivation indicator and minimum value of 50 for intellectual stimulation indicator and motivation. The highest standard deviation is in the motivation indicator with the standard deviation value of 13,463 and the lowest on the exception indicator with a value of 9.397. This means that in every education, motivation indicators have significant differences in each educational institution that is shown by the value of the standard deviation. The standard deviation data results from each indicator are used in hierarchical and non-hierarchical cluster analysis (Lederer and Sethi 1991).

III. Research Results and Discussion

The result of the clustering process is carried out by the method of between group linkage which is then measured by their respective 6 stance to each of them to know the clustering in stages. The result of the clustering can be seen in Table 2.

Table 2. Results of Grouping Agglomeration

Stage		Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
		Cluster 1	Cluster 2		Cluster 1	Cluster 2	
dimension0	1	4	21	.025	0	0	3
	2	19	30	.222	0	0	7
	3	4	18	.405	1	0	13
	4	12	17	.501	0	0	17
	5	23	25	.673	0	0	25
	6	1	8	.716	0	0	14
	7	19	22	.758	2	0	15
	8	2	35	.917	0	0	19
	9	5	6	1.199	0	0	22
	10	15	31	1.278	0	0	12
	11	7	20	1.332	0	0	24
	12	13	15	2.012	0	10	23
	13	4	14	2.080	3	0	16
	14	1	24	2.210	6	0	25
	15	3	19	2.320	0	7	17
	16	4	29	2.426	13	0	18
	17	3	12	2.580	15	4	20
	18	4	16	3.373	16	0	28
	19	2	33	3.503	8	0	22
	20	3	10	3.557	17	0	29
	21	9	26	3.614	0	0	26
	22	2	5	3.672	19	9	23

23	2	13	3.791	22	12	29
24	7	28	4.069	11	0	32
25	1	23	5.009	14	5	31
26	9	27	5.115	21	0	30
27	32	34	5.916	0	0	34
28	4	11	6.162	18	0	31
29	2	3	7.496	23	20	30
30	2	9	8.292	29	26	33
31	1	4	8.854	25	28	32
32	1	7	10.969	31	24	33
33	1	2	11.743	32	30	34
34	1	32	15.175	33	27	0

Based on Table 2 it can be seen that the first grouping results on stage one formed a group consisting of samples 4 and 21 with a distance of 0.025 based on coefficient column data with a value of 0.25. The agglomeration process performs clustering with the closest object of the 35 samples. The clustering is changing based on a particular stage which can be seen in the next stage column which indicates that the existing group changes happen again in stage 3 and ends on stage 34. Agglomeration process is an important part in cluster analysis and is complex because of the calculation of Z-Score coefficient on Any indicator of leadership. This process in the final stages of hierarchical cluster analysis attempts to unite all objects into one cluster which in the process can be seen several clusters with related members of the cluster depending on the number of clusters formed as shown in Table 3.

Table 3. *Sample Grouping Based on Cluster Formation*

Case	4 Clusters	3 Clusters	2 Clusters
1:A	1	1	1
2:B	2	2	1
3:C	2	2	1
4:D	1	1	1
5:E	2	2	1
6:F	2	2	1
7:G	3	1	1
8:H	1	1	1
9:I	2	2	1
10:J	2	2	1
11:K	1	1	1
12:L	2	2	1
13:M	2	2	1
14:N	1	1	1
15:O	2	2	1
16:P	1	1	1
17:Q	2	2	1
18:R	1	1	1
19:S	2	2	1

20:T	3	1	1
21:U	1	1	1
22:V	2	2	1
23:W	1	1	1
24:X	1	1	1
25:Y	1	1	1
26:Z	2	2	1
27:AA	2	2	1
28:BA	3	1	1
29:CA	1	1	1
30:DA	2	2	1
31:EA	2	2	1
32:FA	4	3	2
33:GA	2	2	1
34:HA	4	3	2
35:IA	2	2	1

The calculations on the hierarchy analysis use a limitation with a distance of 2 to 4 clusters as shown in Table 3 which shows the existence of each sample on the division of two clusters up to four clusters. In detail the process of cluster formation with hierarchy analysis method can be seen in the dendogram which has a function as a marker of cluster members that exist if determined how many clusters should be formed. As shown in Figure 1 it can be seen that if two clusters are formed, then cluster one will have a member of sample D until the GA sample is based on the sequence seen in the dendogram. Whereas cluster two has members from FA samples to HA samples. This dendogram itself then shows that in the process of clustering leadership in educational institutions formed several clusters.

Figure 1. *Dendogram Cluster Hierarchy Leadership in nonformal education in Gorontalo province in 2017*
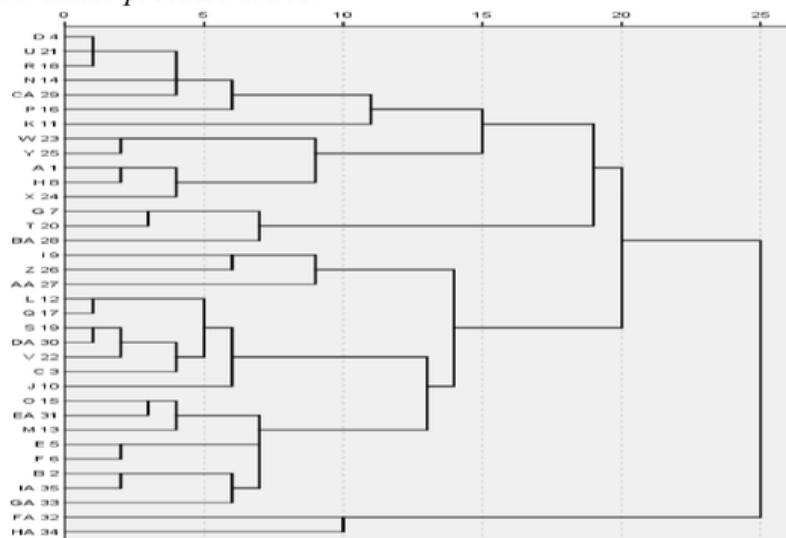
To find out the cause of the cluster formation, non-hierarchy analysis based on Zscore of each indicator and iteration process as shown in Table 4 to know the distance of coordinate change of each sample.

Table 4. *Iterations of Non-Hierarchical Cluster Analysis*

Iteration		Change in Cluster Centers			
		1	2	3	4
dimension0	1	1.582	1.855	1.203	1.625
	2	.244	.183	.000	.000
	3	.191	.121	.000	.000
	4	.262	.000	.000	.191
	5	.273	.000	.000	.154
	6	.000	.000	.000	.000

a. Convergence achieved due to no or small change in cluster centers. The maximum absolute coordinate change for any center is .000. The current iteration is 6. The minimum distance between initial centers is 3.689.

It can be seen that the iteration process is done as much as 6 times with minimum distance between cluster centers that occur from iteration result is 3,632. Furthermore, based on the results of ANOVA from each sample can be seen what indicators make the cluster is different as shown in Table 5.

Table 5. *Anova Non Cluster Analysis - Hierarchy*

	Between Mean Square	df	Within Mean Square	df	F	Sig.
Zscore: Charisma	3.715	3	.737	31	5.039	.006
Zscore: Intellectual Stimulation	4.647	3	.647	31	7.182	.001
Zscore: Motivation	7.859	3	.336	31	23.375	.000
Zscore: Exception	6.052	3	.511	31	11.839	.000
Zscore: Exception	4.090	3	.701	31	5.835	.003

Based on Table 5 can be seen the value of F and probability value (sig.) of each indicator MLQ tested and the value meansquare between and meansquare within. The result shows that the biggest indicator difference is in motivation indicator with F value 23,375 with sig is smaller than 0.000. While most indicators do not show the difference is the charisma indicator with the value of F of 5,039 and sig of 0.006. Table 6 shows the final cluster centers

Table 6. *Final Cluster Centers*

		Final Cluster Centers			
		1	2	3	4
Zscore: Charisma		.17710	-.82596	.77951	.19524
Zscore:	Intellectual	-.03465	-.72484	1.20229	.02310

Stimulation				
Zscore: Motivation	.97201	.27271	.58469	-1.08661
Zscore: Exception	-.33647	1.12685	-.66203	-.41175
Zscore: Exception	-.97291	.49254	.68408	-.18496

Furthermore, a calculation analysis based on Zscore standardization on four clusters formed as shown in table 1.5 shows the corresponding cluster zscore value. The negative value (-) means the data is below the total mean while the positive value (+) means the data is above the total average. Cluster one is a cluster that has high charisma and high motivation value but has low value on intellectual stimulation, Rewards, and exceptions. The second cluster contains educational institutions that have low scores on charisma and intellectual stimulation but have above average values on motivational indicators, rewards, and exceptions. Meanwhile cluster three has a low score on awards but the other four indicators have values above the zscore average. The fourth cluster or the last cluster has a positive value on charisma and intellectual stimulation but has a low score on motivational indicators, rewards, and exceptions. Differences in the value of indicators based on the zscore on each cluster can be used as a profiling of the types of leadership in the institution studied. The four clusters have significant differences with the members in each cluster shown in Table 7.

Table 7. *Class Members and Distance Sample*

Cluster 1		Cluster 2		Cluster 3		Cluster 4	
LP	Distance	LP	Distance	LP	Distance	LP	Distance
A	1.15954	B	1.37366	G	1.74707	C	1.75998
H	0.43548	E	1.50269	I	1.56442	D	1.7676
L	2.05595	F	1.0315	T	1.85524	K	2.28342
P	1.69981	J	2.46981	Z	1.43513	M	1.70251
W	1.21021	O	1.42239	AA	2.21189	N	1.39099
X	1.58449	EA	1.07544	BA	1.20318	Q	1.69226
Y	1.46296	FA	2.34207			R	1.43501
		GA	1.08976			S	1.34783
		HA	2.02736			U	1.85273
		IA	0.72194			V	1.60697
						CA	1.20185
						DA	1.59462

Based on Table 7 it can be seen that each cluster has different members and the distance from each sample at the center of the cluster can be seen in the distance column. While the LP column shows which educational institutions that enter into the cluster. It can be seen that cluster one has seven members, cluster two has ten members, cluster three has six members, and cluster four has twelve members.

III. Conclusion

Based on the analysis it can be seen that each educational institution has a unique leadership style and has a tendency of closeness with certain leadership indicators. Based on data from the profiling of every educational institution it can be seen that there are four main clusters with profiling in each cluster as shown in Table 8 on the cluster profiling essence.

Table 8. *Individual Cluster: Cluster Value Indicator Interpretation*

Cluster	Value Indicator	Interpretation
One	• Charisma (+) • Motivation (+) • Intellectual stimulation (-) • Appreciation (-) • Exceptions (-)	These clusters can be interpreted as educational institutions that have a transformational leadership model and emphasize the leader's charisma and especially motivation to his members. This cluster can be called charismatic and motivational Transformational.
Two	• Charisma (+) • Motivation (+) • Intellectual stimulation (-) • Appreciation (-) • Exceptions (-)	These clusters can be interpreted as educational institutions that have a transactional leadership model but have a combination with transformational leadership characteristics, especially motivation. This cluster can be called Transactional and Motivational
Three	• Charisma (+) • Motivation (+) • Intellectual stimulation (-) • Appreciation (-) • Exceptions (-)	These clusters can be interpreted as educational institutions that have a transformational leadership model but have a combination of transactional leadership characteristics, especially exceptions. This cluster can be called Transformational and Exceptions
Four	Charisma (+) • Motivation (+) • Intellectual stimulation (-) • Appreciation (-) • Exceptions (-)	These clusters can be interpreted as educational institutions that have a transformational leadership model and emphasize the leader's charism and especially the intellectual stimulation of its members. This cluster can be called Transformational Intellectual and Charismatic.

In the end it can be seen that every educational institution that has been clustered has models that are considered close to the transformational or transactional leadership model. Interestingly, some clusters have a combination model between the transfornational and transactional models. This shows that the transformational model or transactional model is the best model that can be used. It could be a combination between the two models can be used to achieve the best results in accordance with the conditions that exist in each educational institution.

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