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Analysis of confirmatory factors of principals' leadership training of vocational high school

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ABSTRACT

One of the main problems in the course of management in Vocational High School is the principal's leadership training problem. Great leadership training has an impact on improving the quality of schools, the quality of teachers, and the professionalism of teachers in carrying out educational activities. This research aimed to find out what is the result of Confirmatory Factor Analysis (CFA) on leadership training indicators for the principals of Vocational High School based on the perception of teachers, principals, and students. The method used in this research is a quantitative method to find out the result of Confirmatory Factor Analysis leadership training for principals of Vocational High School. This research used a simple random sampling technique with 255 teachers, 57 principals, and 315 students as the sample. The data analysis applied is KMO (Keiser-Meyer-Olkin Measure of Sampling Adequacy) and Bartlett's Test of Sphericity. Extraction Method with Principal Component Analysis. The result of the study shows that the teacher sample obtained the KMO value 0,737 which indicates sample suitability is high (>0,5), and the lowest value of MSA (Measure of Sampling Adequacy) is 0,550. Meanwhile, the highest is 0,852, communalities value and appropriate matrix components, loading factor on all variables have met the requirements above 0,40, and all factors on the leadership training instruments for the principal of Vocational High School have an AVE value greater than 0,5; thus, they have met reliability and can be accepted. The principal sample obtained the KMO value of 0,738, and the lowest value of MSA (Measure of Sampling Adequacy) is 0,556. The highest is 0,859 indicating communalities value appropriate matrix components. Loading factors on all variables are above 0,40, and all factors on the leadership training instruments for the principal of Vocational High School have an AVE value greater than 0,5. The student sample obtained the KMO value is 0,682, the lowest value of MSA (Measure of Sampling Adequacy) is 0,556 and the highest is 0,859; communalities value and appropriate matrix components, loading factor on all variables are above 0,40, and all factors on the leadership training instruments for the principal of Vocational High School have an AVE value greater than 0,5. Thus, they have met reliability and can be accepted.

Keywords: confirmatory factor analysis, leadership, principal

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INTRODUCTION

Great leadership training will have an impact on teacher performance in carrying out educational activities (Kuswaeri, 2020). To assess the real leadership training of school principals, it is obligatory to conduct research on assessment development as an effort to improve teacher performance. (Cheng, 2017; Choi & Davis, 2008).). Because one of the factors that affect the quality of training is the teacher variable. Research conducted by Heyneman & Loxley (Dedi Supriadi, 1999) in 29 countries found that among the various inputs that determine the quality of education (shown by student achievement) the one third is determined by teachers.

The teacher's most dominant factor influencing the quality of learning is the teacher's performance (Baglier, et al, 2014; Benwari & Dambo, 2014). The result of a study done by

(Sudjana, 2002) shows that 76,6% of student learning outcomes are influenced by teacher performance, with details: teacher's ability to teach contributed 32.43%, mastery of subject matter contributed 32.38% and teacher attitudes towards subjects contributed 8.60%. The research done by Darling & Hammond (2000) from Standford University shows that the results of quantitative analysis are the quality of teachers has a very strong correlation to student achievement. The same result is also shown by Schacter (2006) from Milken Family Foundation who states that teacher performance is an important variable in improving student achievement (Burke, 2010; Biasutti & EL-Deghaidy, 2012).

McLeod & Schell (2017) arrange models into four types physical models, narrative models, graphical models, and mathematical models. The leadership training of the principal is leadership that involves learning aspects ranging from managing, directing, and empowering teachers as human resources in addition to other resources to achieve learning goals. (Diwijaya. 2009; Herlinger: 2009; Habibi et al., 2020). Principals as learning leaders in schools are required to continuously improve the effectiveness of their performance so that they can improve the quality of education and achieve school and educational goals (Robinson, 2009; Leavitt, 2005; Kawuryan et al., 2021). The leadership training of principals consists of component that are closely related to learning, including curriculum, teaching and learning process, assessment, teacher development, first-rate service in learning, and building a learning community in schools all of which affect improving teacher performance (Abazi-Bexheti et al., 2018; Kasim & Khalid, 2021; Derure et al, 2011).

According to Usman (2018) as the number one person in the school, the principal has a strategic function. The principal as a learning leader at the school level has the prominent task of managing the implementation of educational and learning activities in schools (Kadir & Aziz, 2016; Supriyadi, 2021; Setiawan et al., 2020). Operationally, the principal's prominent task includes activities to explore and utilize all school resources in an integrated manner within the framework of achieving school goals effectively and efficiently. According to Harold J. Leavitt (2005)"managers or leaders, in one way or another, must influence other people to do what managers want them to do."Holified & Cline (2007) states that one of the main tasks of the principal is to improve teacher performance. Dufur & Barkey (2005) also stated that the success of school refinement depends on professional improvement efforts within schools, and most importantly, the professional improvement of teachers. At the same time, there is also the term collaborative leadership so that educational goals and political goals are achieved (Silva, 2018; Aman et al., 2020; Büchi et al., 2019; Lusk, 2010).

As a leader, the principal is one of the determining factors that can encourage schools to realize their vision, mission, goals, and objectives through various planned programs. (Ghaffarzadeh, 2015; Hariri et al, 2014; James et al, 2008). The role of the principal is responsible for the coordination of educational activities, school administration, training of educational staff, and the utilization and maintenance of infrastructure (Bogdanović et al., 2014; Mtebe, 2015; Akmaliyah et al, 2020; Yuliana et al., 2019). This research focuses on confirmatory factor analysis (CFA). Factor analysis techniques have two kinds of approaches, those are analysis exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). EFA is a factor analysis technique in which a priori researchers still have unknown hypotheses regarding the number of factors and which variables are related to certain factors. (Hunt & Pellegrino, 2002; Kafkova et al, 2018; Kasprzhak & Bysik, 2015).

While CFA is a factor analysis technique that a priori has known or determined which variables are related to many factors. (Telem & Pinto, 2006; Triwiyanto, 2015). The application of this approach in the factor analysis method can be determined by taking into account the basic objectives in analyzing. EFA is used when the basic objective is to determine the number of factors that must be minimum, that is by taking into consideration the maximum variance in the data for use in further multivariate analysis. (Prasojo & Yuliana, 2021). Whereas CFA is used if the basic purpose is to identify the factors which underlie a construct (Erlina, et al, 2019; Khine, 2015). In this study, the approach used for factor analysis is the confirmatory analysis factor (CFA), which is for statistically confirm the indicators which the researcher has built (Doherr et al, 2017; Dorman et al, 2006). The approach in this factor analysis was then used by researchers

to find out the level of importance of the principal's leadership training indicator for Vocational High School.

Confirmatory factor analysis is a factor analysis technique in which a priori has known or determined previously which variables are related to many factors. (Gudono, 2011; Lizarragaa et al, 2009; Hasnida 2016). According to Purwanto (2012), Confirmatory factor analysis hypothesizes that several factors from the variables have been identified and analysis is conducted to confirm the independence of the factors and examine the contribution of the items to the factors. Whereas, according to Hair, Anderson, Tatham, Black (1995), confirmatory factor analysis is a factor analysis that intends to summarize or reduce the observed variables as a whole into several new variables or factors but the newly formed variables or factors are still able to represent the main variables used if the formed factors have been determined previously (Pornpandejwittaya, 2012; Reyneke et al, 2010). Based on those definitions, it can be stated that confirmatory factor analysis is a technique in which a priori, theories, and concepts that have been known or determined previously by the indicators to be applied in research so that in conducting the analysis, several factors will be formed and variables which are included in the formated factor (Edelman et al., 2020; Moore et al., 2020; Prasojo et al., 2020). Therefore, for the application of confirmatory factor analysis, the purpose is discovered previously. The main objective of confirmatory factor analysis is to find out the latent variables that underlie the original variables (Ghazali, et al 2020; Gehlawat, 2014; Stajkovic & Luthans, 2001). Furthermore, confirmatory analysis also aims to test the validity and reliability of the instrument. Testing the validity and reliability of this instrument needs to be done in conducting research using confirmatory factor analysis, researchers find valid and reliable data. (Silich et al, 2016) Basically, this confirmatory factor analysis technique is applied to develop or to test a theoretical concept or theory, especially a theory developed by researchers or a theory that has long been developed by others (Slater, 2005). The approach in this factor analysis was then used by researchers to determine the levels of importance of the principal's leadership training indicator for Vocational High School. Based on the formulation of the research problem, the purpose of this study is to thoroughly find out the results of confirmatory factor analysis (CFA) on principal's leadership training indicators for Vocational High School in the Special Region of Yogyakarta based on the perceptions of teachers, principals, and students.

METHOD

The research design is a quantitative method to find out the results of the confirmatory factor analysis of the principal's leadership training for Vocational High School. The method used in the analysis and this discussion was confirmatory factor analysis (CFA) to determine the validity-reliability of the contribution of each indicator that composes the latent variable. This study tried to identify as accurately as possible what indicators construct the principal's leadership training for Vocational High School in the Special Region of Yogyakarta. Then, the results of the confirmatory factor analysis of the principal's leadership training for Vocational High School in the Special Region of Yogyakarta as an important element to be used as a guide for the principal in leading the leadership training for Vocational High School for reaching the management goals. The sampling technique used was simple random sampling with 255 teachers, 57 principals, and 315 students. The data analysis used KMO (Keiser-Meyer-Olkin Measure of Sampling Adequacy) and Bartlett's Test of Sphericity. KMO is used to measure the suitability of the sample, while Bartlett's Test of Sphericity is used to observe whether the factors in the variables are significantly correlated. The result of the KMO value must be above 0.5 so that the factor is suitable for use in research. If the value of Bartlett's Test of Sphericity and its significance is expected to be very small (<0.05), there is a significant relationship between variables. Factor analysis in this study used the Principal Component Analysis and its rotation with Varimax Rotation. Question items from each variable are expected to have factor loadings > 0.40. The higher the factor loading number, the better the construct validity of a variable.

The next step is to calculate the Anti-Images matrix. The numbers in this matrix indicate partial correlations between variables, namely correlations that are not influenced by other

variables. In the confirmatory factor analysis used common variance. Common variance is the total variance minus the specific variance and error variance, so the value for the common variance is less than one. This is why in communalities the initial variance is not equal to one. Communalities is the total variance explained by the extracted factors. The next step is to determine the factor matrix. The factor matrix is presented in tabular form which contains factor loading or the correlation value between each factor and the analysis variables. Not all variables in the factor matrix can be included, therefore rotation is required. Rotation is done by rotating factors that have not been rotated. The rotation conducted in this study is orthogonal rotation using the Varimax rotation method. Varimax rotation is a perpendicular rotation that aims to improve the interpretation of the factors obtained. If the included variables can be determined, then the forming factors which represent the indicator variables are formed. In this study, researchers used SPSS 23.0 software which has provided facilities to assist the calculation process using confirmatory factor analysis.

The Anti-Images matrix is used to see if there are factors that should not be included in the factor analysis because they have a very small level of significance. In this matrix, there will be several values that form a diagonal marked "a" which indicates the MSA factor value (Measure of Sampling Adequacy). If there is an MSA value that is less than 0.5 then the indicator should be discarded (not included in the test). The calculation of the AVE value is conducted to determine convergent validity which is more intended to measure the percentage of variance from a series of indicators that can be extracted or explained by the latent variable. The statistical program used to analyze this factor is using SPSS version 23.00. Using this kind of analysis aims to determine several property variables, the steps that need to be considered are identifying the variables studied, sorting the data, and using appropriate statistical techniques to describe the data.(Hair et al., 2019; Pallant, 2001).

FINDINGS AND DISCUSSION

Findings

Principal's leadership training for Vocational High School based on teacher perceptions

1. The feasibility model

The feasibility of the model is carried out using KMO (Keiser-Meyer-Olkin Measure of Sampling Adequacy) dan Bartlett's Test of Sphericity. KMO. KMO is used to measure the suitability of the sample, while Bartlett's Test of Sphericity is used to find out used whether the variable factors are significantly correlated. The resulting KMO value must be above 0.5 so that the factor is suitable for use in research. If the value of Bartlett's Test of Sphericity and its significance is expected to be very small (<0.05), there is a significant relationship between the variables. The results of the analysis are presented in the table 1.

Table 1. KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.737
Bartlett's Test of Sphericity	Approx. Chi-Square	7199.880
	df	435
	Sig.	.000

Based on the table above, the KMO value is 0.737, which means that the factors have a strong significant correlation. The KMO value indicates the suitability of the sample is high (> 0.5).

2. Anti-images matrix

The Anti-Images matrix is used to see if there are factors that should not be included in the factor analysis because they have a very small level of significance. In this matrix, there will be some values that form a diagonal marked "a" which indicates the MSA (Measure of Sampling Adequacy) factor. If there is an MSA value that is less than 0.5 then the indicator should be

discarded (not included in the test). The results of the analysis of the MSA (Measure of Sampling Adequacy) value with the lowest value is 0.550. and the highest is 0.852. From these results, all question/statement items were not discarded.

3. Communalities value

The communalities is the value of the variance explained by the factors formed for each research variable. The values of communalities are presented in the following table.

Table 2. Communalities

	Initial	Extraction
dlo_1	1.000	.840
dlo_2	1.000	.914
dlo_3	1.000	.808
dlo_4	1.000	.840
pr_1	1.000	.808
pr_2	1.000	.728
pr_3	1.000	.821
ccla_1	1.000	.713
ccla_2	1.000	.748
ccla_3	1.000	.746
ccla_4	1.000	.858
ccla_5	1.000	.810
csvms_1	1.000	.703
csvms_2	1.000	.820
csvms_3	1.000	.652
csvms_4	1.000	.739
csasg_1	1.000	.759
csasg_2	1.000	.743
csasg_3	1.000	.651
csasg_4	1.000	.679
csasg_5	1.000	.778
dtp_1	1.000	.813
dtp_2	1.000	.850
dtp_3	1.000	.876
dtp_4	1.000	.808
patsp_1	1.000	.837
patsp_2	1.000	.871
patsp_3	1.000	.905
patsp_4	1.000	.786
patsp_5	1.000	.643

Extraction Method: Principal Component Analysis.

4. Matrix component

The matrix component is a matrix that shows how much the indicator/item influence the research variables. The indicator with the greatest influence on the research variable is the one with the largest matrix component value. The results of the analysis of the highest matrix components in each factor.

Table 3. The highest value of matrix component

No.	Factors	Most influential indicator/item	Value of matrix component
1.	Determining the Learning Objectives (DLO)	DLO_2	0,730
2.	Principal as Respondent (PR)	PR_2	0,605
3.	Creating a Conducive Learning Atmosphere (CCLA)	CCLA_2	0,711
4.	Communicating School's Vision, Mission to Staff (CSVMS)	CSVMS_1	0,722
5.	Conditioning the Staff to Achieve School's Goals (CSASG)	CSASG_1	0,521
6.	Developing Teacher Professionalism (DTP)	DTP_1	0,511
7.	Positive Attitude toward Teachers, Staff, Students, and Parents (PATSP)	PATST_3	0,754

5. Eigenvalue

Eigenvalue is the amount of variance explained by each factor, and only eigenvalues over 1 are included in the model. The analysis result of the total component from "Initial Eigenvalues" which are above 1 and in this study determined the number of factors is 7.

Table 4. Total variance explained

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.842	22.807	22.807	6.842	22.807	22.807
2	4.311	14.371	37.178	4.311	14.371	37.178
3	4.012	13.372	50.551	4.012	13.372	50.551
4	2.675	8.918	59.468	2.675	8.918	59.468
5	2.367	7.889	67.358	2.367	7.889	67.358
6	1.991	6.636	73.994	1.991	6.636	73.994
7	1.348	4.492	78.486	1.348	4.492	78.486
8	1.056	3.522	82.008			

Extraction Method: Principal Component Analysis.

6. Loading factor

Factor analysis in this study used the Principal Component Analysis extraction method and its rotation with Varimax Rotation. Question items from each variable are expected to have factor loadings > 0.40. The higher the factor loading number, the better the construct validity of a variable. The loading factor for each variable is presented in the following table.

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
patsp_2	.903						
patsp_1	.884						
patsp_3	.884						
patsp_4	.758						
patsp_5	.721						
ccla_4		.910					
ccla_5		.848					
ccla_2		.838					
ccla_1		.826					
ccla_3		.817					
csasg_2			.852				
csasg_5			.847				
csasg_1			.846				
csasg_3			.789				
csasg_4			.785				
dtp_3				.914			
dtp_2				.909			
dtp_4				.864			
dtp_1				.860			
dlo_2					.872		
dlo_1					.860		
dlo_4					.849		
dlo_3					.821		
csvms_2						.830	
csvms_1						.800	
csvms_4						.785	
csvms_3						.757	
pr_3							.881
pr_1							.845
pr_2							.835

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

[a.] Rotation converged in 6 iterations.

Based on the tables above, it is discovered that the loading factor on all variables has met the requirements, which is above 0.40.

7. Reliability test (AVE and CR value)

The calculation of the AVE value is to determine the convergent validity which is intended to measure the percentage of variance from a series of indicators that can be extracted or explained by the latent variable. A high AVE value indicates that the indicators have great represented the developed variables and are accepted if they are greater than 0.5.

Table 5. AVE and CR values

No.	Factors	Construct Reliability (CR)	Average Variance Extracted (AVE)
1.	Determining the Learning Objectives (DLO)	0,913	0,723
2.	Principal as Respondent (PR)	0,890	0,729
3.	Creating a Conducive Learning Atmosphere (CCLA)	0,928	0,720
4.	Communicating School's Vision, Mission to Staff (CSVMS)	0,872	0,630
5.	Conditioning the Staff to Achieve School's Goals (CSASG)	0,914	0,679
6.	Developing Teacher Professionalism (DTP)	0,937	0,787
7.	Positive Attitude toward Teachers, Staff, Students, and Parents (PATSP)	0,919	0,694

The table above describes that all the factors on the leadership training instrument for the principal of Vocational High School have an AVE value greater than 0.5; thus, has met the reliability and can be accepted.

Principal's leadership training for Vocational High School based on principal perception

1. The feasibility model

The feasibility of the model was conducted using KMO (Keiser-Meyer-Olkin Measure of Sampling Adequacy) and Bartlett's Test of Sphericity. KMO is used to measure the suitability of the sample, while Bartlett's Test of Sphericity is used to find out whether the factors in the variables are significantly correlated. The resulting KMO value must be above 0.5 so that the factor is feasible to be applied in research. If the value of Bartlett's Test of Sphericity and its significance is expected to be very small (<0.05), there is a significant relationship between the variables. The results of the analysis are presented in the following table.

Table 6. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.738
Bartlett's Test of Sphericity	Approx. Chi-Square	7176.729
	df	435
	Sig.	.000

Based on the table above, the KMO value is 0.738, which means that the factors have a strong significant correlation. The KMO value indicates the suitability of the sample is high (> 0.5).

2. Anti-images matrix

The Anti-Images matrix is used to find out if there are factors that should not be included in the factor analysis because they have a very small level of significance. In this matrix, there will be a number of values that form a diagonal marked "a" which indicates the MSA (Measure of Sampling Adequacy) factor. If there is an MSA value that is less than 0.5 then the indicator should be discarded (not included in the test). The results of the analysis of the MSA (Measure of Sampling Adequacy) value with the lowest value of 0.556. and the highest is 0.859. From these results, all question/statement items were not discarded.

3. Communalities value

The value of communalities is the value of the variance explained by the factors formed for each research variable. The values of communalities are presented in the following table.

Table 7. Communalities

	Initial	Extraction
dlo_1	1.000	.835
dlo_2	1.000	.910
dlo_3	1.000	.791
dlo_4	1.000	.844
pr_1	1.000	.814
pr_2	1.000	.721
pr_3	1.000	.822
ccla_1	1.000	.703
ccla_2	1.000	.749
ccla_3	1.000	.743
ccla_4	1.000	.859
ccla_5	1.000	.806
csvms_1	1.000	.723
csvms_2	1.000	.817
csvms_3	1.000	.648
csvms_4	1.000	.725
csasg_1	1.000	.756
csasg_2	1.000	.745
csasg_3	1.000	.650
csasg_4	1.000	.681
csasg_5	1.000	.776
dtp_1	1.000	.814
dtp_2	1.000	.850
dtp_3	1.000	.875
dtp_4	1.000	.806
patsp_1	1.000	.836
patsp_2	1.000	.874
patsp_3	1.000	.906
patsp_4	1.000	.783
patsp_5	1.000	.643

Extraction Method: Principal Component Analysis.

4. Matrix component

The matrix component is a matrix that shows how much the indicators/items influence the research variables. The indicator that has the greatest influence on the research variable is the one with the largest matrix component value. The results of the analysis of the highest matrix components in each factor.

Table 8. The highest value of matrix component

No.	Factors	Most influential indicator/item	Value of matrix component
1.	Determining the Learning Objectives (DLO)	DLO_2	0,728
2.	Principal as Respondent (PR)	PR_2	0,589
3.	Creating a Conducive Learning Atmosphere (CCLA)	CCLA_2	0,709
4.	Communicating School's Vision, Mission to Staff (CSVMS)	CSVMS_1	0,725
5.	Conditioning the Staff to Achieve School's Goals (CSASG)	CSAGS_5	0,577
6.	Developing Teacher Professionalism (DTP)	DTP_4	0,563
7.	Positive Attitude toward Teachers, Staff, Students, and Parents (PATSP)	PATSP_3	0,755

5. Eigenvalue

Eigenvalue is the amount of variance explained by each factor, and only eigenvalues above 1 are included in the model. The results of the analysis of the number of components from "Initial Eigenvalues" are above 1 and in this study the number of factors determined is 7.

Table 9. Total variance explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.849	22.829	22.829	6.849	22.829	22.829
2	4.303	14.344	37.174	4.303	14.344	37.174
3	4.002	13.341	50.515	4.002	13.341	50.515
4	2.671	8.903	59.418	2.671	8.903	59.418
5	2.356	7.855	67.273	2.356	7.855	67.273
6	1.972	6.575	73.847	1.972	6.575	73.847
7	1.35	4.501	78.348	1.35	4.501	78.348
8	1.072	3.574	81.922			

Extraction Method: Principal Component Analysis.

6. Loading factor

Factor analysis used in this study is the Principal Component Analysis and its rotation with Varimax Rotation. Question items from each variable are expected to have factor loadings > 0.40. The higher the factor loading, the better the construct validity of a variable. The loading factor for each variable is presented in the following table.

Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
patsp_2	.905						
patsp_1	.884						
patsp_3	.882						
patsp_4	.751						
patsp_5	.722						
ccla_4	.088	.913					
ccla_5		.854					
ccla_2		.839					
ccla_1		.820					
ccla_3		.814					
csasg_2			.853				
csasg_5			.846				
csasg_1			.845				
csasg_3			.791				
csasg_4			.784				
dtp_3				.914			
dtp_2				.909			
dtp_4				.863			
dtp_1				.862			
dlo_2					.869		
dlo_1					.855		
dlo_4					.853		
dlo_3					.815		
csvms_2						.824	
csvms_1						.817	
csvms_4						.771	
csvms_3						.733	
pr_3							.882
pr_1							.851
pr_2							.827

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

[a.] Rotation converged in 6 iterations.

Based on the tables, it is known that the loading factor on all variables has met the requirements or is above 0.40.

7. Reliability test (AVE and CR values)

The calculation of the AVE value is to determine the convergent validity which is more aimed at measuring the percentage of variance from a series of indicators that can be extracted or explained by the latent variable. A high AVE value indicates that the indicators have well represented the developed variables and are accepted if they are greater than 0.5.

Table 10. AVE and CR Values

No.	Factors	Construct Reliability (CR)	Average Variance Extracted (AVE)
1.	Determining the Learning Objectives (DLO)	0,911	0,720
2.	Principal as Respondent (PR)	0,889	0,728
3.	Creating a Conducive Learning Atmosphere (CCLA)	0,928	0,720
4.	Communicating School's Vision, Mission to Staff (CSVMS)	0,867	0,620
5.	Conditioning the Staff to Achieve School's Goals (CSASG)	0,914	0,680
6.	Developing Teacher Professionalism (DTP)	0,937	0,787
7.	Positive Attitude toward Teachers, Staff, Students, and Parents (PATSP)	0,918	0,693

The table above shows that all the factors in the training leadership instrument for the principal of Vocational High School have an AVE value greater than 0.5; thus, has met the reliability and can be accepted.

Training leadership of Vocational High School principals, based on student perceptions

1. Feasibility of the model

Feasibility of the model was using KMO (Keiser-Meyer-Olkin Measure of Sampling Adequacy) and Bartlett's Test of Sphericity. KMO was used to measure the suitability of the sample, while Bartlett's Test of Sphericity was used to see whether the factors in the variables were significantly correlated. The resulting KMO value must be above 0.5 so that the factor is feasible to be used in research. If the value of Bartlett's Test of Sphericity and its significance is expected to be very small (<0.05), there is a significant relationship between the variables. The results of the analysis are presented in the following table.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.682
Bartlett's Test of Sphericity	Approx. Chi-Square	2919.039
	df	136
	Sig.	.000

Based on the table, the KMO value is 0.682, meaning that the factors have a very significant correlation. The KMO value indicates the suitability of the sample is high (> 0.5).

2. Anti-images matrix

Anti-Images Matrix is used to see if there are factors that should not be included in the factor analysis because they have a very small level of significance. In this matrix, there will be a number of values that form a diagonal marked as "a" which indicates the MSA (Measure of Sampling Adequacy) factor. If there is an MSA value that is less than 0.5 then the indicator should be discarded (not included in the test). The results of the analysis of the MSA (Measure of

Sampling Adequacy) value with the lowest value of 0.519. and the highest is 0.854. From these results, all question/statement items were not discarded.

3. Communalities value

Communalities Value is the value of the variance explained by the factors formed for each research variable. The values of communalities are presented in the following table

Table 11. Communalities

	Initial	Extraction
dlo	1.000	.949
pr_1	1.000	.766
pr_2	1.000	.820
ccla_1	1.000	.732
ccla_2	1.000	.714
ccla_3	1.000	.789
csvms_1	1.000	.921
csvms_2	1.000	.919
csasg_1	1.000	.642
csasg_2	1.000	.884
csasg_3	1.000	.830
dtp_1	1.000	.883
dtp_2	1.000	.876
patsp_1	1.000	.802
patsp_2	1.000	.863
patsp_3	1.000	.888
patsp_4	1.000	.771

Extraction method: Principal component analysis.

4. Matrix component

The matrix component is a matrix that shows how much the indicators/items influence the research variables. The indicator that has the greatest influence on the research variable is the one with the largest matrix component value. The result of the analysis of the components of the matrix is the highest for each factor.

Table 12. The Highest Value of Matrix Component

No.	Factors	Most Influential Indicator/Item	Value of Matrix Component
1.	Determining the Learning Objectives (DLO)	DLO	0,777
2.	Principal as Respondent (PR)	PR_2	0,690
3.	Creating a Conducive Learning Atmosphere (CCLA)	CCLA_1	0,646
4.	Communicating School's Vision, Mission to Staff (CSVMS)	CSVMS_1	0,833
5.	Conditioning the Staff to Achieve School's Goals (CSASG)	CCASG_1	0,506
6.	Developing Teacher Professionalism (DTP)	DTP_2	0,587
7.	Positive Attitude toward Teachers, Staff, Students, and Parents (PATSP)	PATSP_3	0,861

5. Eigenvalue

Eigenvalue is the amount of variance explained by each factor, and only eigenvalues above 1 are included in the model. The results of the analysis of the number of components from "Initial Eigenvalues" are above 1 and in this study the number of factors determined is 7.

Table 13. Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.971	23.361	23.361	3.971	23.361	23.361
2	2.441	14.359	37.72	2.441	14.359	37.72
3	2.172	12.775	50.495	2.172	12.775	50.495
4	1.703	10.018	60.513	1.703	10.018	60.513
5	1.667	9.807	70.32	1.667	9.807	70.32
6	1.278	7.516	77.836	1.278	7.516	77.836
7	0.819	4.816	82.652	0.819	4.816	82.652
8	0.61	3.588	86.241			

Extraction Method: Principal Component Analysis.

6. Loading Factor

Factor analysis in this study used the Principal Component Analysis and rotation with Varimax Rotation. Question items from each variable are expected to have factor loadings > 0.40. The higher the factor loading, the better the construct validity of a variable. The loading factor for each variable is presented in the following table.

Table 14. Rotated Component Matrix[a]

	Component						
	1	2	3	4	5	6	7
patsp_3	.906						
patsp_2	.897						
patsp_1	.863						
patsp_4	.845						
ccasg_2		.923					
ccasg_3		.902					
ccasg_1		.749					
ccla_3			.847				
ccla_1			.824				
ccla_2			.821				
csmvs_1				.951			
csmvs_2				.946			
dtp_1					.929		
dtp_2							
pr_2						.898	
pr_1							
dlo							.939

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

[a.] Rotation converged in 5 iterations.

Based on the tables, it is known that the loading factor on all variables has met the requirements, which is above 0.40.

7. Reliability Test (AVE and CR Values)

The calculation of the AVE value is to determine the convergent validity which is more aimed at measuring the percentage of variance from a series of indicators that can be extracted or explained by the latent variable. A high AVE value indicates that the indicators have well represented the developed variables and are accepted if they are greater than 0.5.

Table 15. AVE and CR Values

No.	Factors	Construct Reliability (CR)	Average Variance Extracted (AVE)
1.	Determining the Learning Objectives (DLO)	0,882	0,882
2.	Principal as Respondent (PR)	0,861	0,757
3.	Creating a Conducive Learning Atmosphere (CCLA)	0,870	0,690
4.	Communicating School's Vision, Mission to Staff (CSVMS)	0,947	0,900
5.	Conditioning the Staff to Achieve School's Goals (CSASG)	0,895	0,742
6.	Developing Teacher Professionalism (DTP)	0,922	0,855
7.	Positive Attitude toward Teachers, Staff, Students, and Parents (PATSP)	0,865	0,617

The table above shows that all the factors on the training leadership instrument for the principal of Vocational High School have an AVE value greater than 0.5; thus has met the reliability and can be accepted.

Discussion

Based on the results of the Confirmatory Factor Analysis (CFA) on leadership training for the principals of Vocational High School in the Special Region of Yogyakarta, and based on the analysis of the 3 groups of respondents, teachers, principals, and students, 7 confirmatory factors of the leadership training for the principal were constructed. The results showed that both in the teacher sample, the KMO value was 0.737 where the KMO value indicated the suitability of the sample was high (>0.5), if Bartlett's Test of Sphericity value and its significance were expected to be very small (<0.05) so that there was a significant relationship between variable, the value of MSA (Measure of Sampling Adequacy) with the lowest value of 0.550. and the highest is 0.852, the values of communalities and components of the matrix are appropriate, the loading factor on all variables has met the requirements, which are above 0.40, and all factors on the training leadership instrument of the Vocational High School principal have an AVE value greater than 0.5; thus has met the reliability and can be accepted. The principal sample KMO score is 0.738, and the MSA (Measure of Sampling Adequacy) score with the lowest score is 0.556. and the highest is 0.859, the values of communalities and components of the matrix are appropriate, the loading factor on all variables is above 0.40, and all factors on the training leadership instrument of Vocational High School principals have an AVE value greater than 0.5. For the student sample, the KMO score was 0.682, the MSA (Measure of Sampling Adequacy) value was the lowest at 0.556. and the highest is 0.859, the values of communalities and components of the matrix are appropriate, the loading factor on all variables is above 0.40, and all factors on the training leadership instrument for the principal of Vocational High School have an AVE value greater than 0.5; thus has met the reliability and can be accepted. Based on the results of the analysis of the three groups of respondents, the KMO value (> 0.5), the MSA (Measure of Sampling Adequacy) is normal, the loading factor on all variables has met the requirements, which is above 0.40, and all factors on the training leadership instrument the principal of Vocational High School has an AVE value greater than 0.5; thus has met the reliability and can be accepted. Barlett Test of sphericity is a statistical test to determine whether the variables involved are correlated. The hypothesis used is that there is no correlation between variables for the null hypothesis and there is a correlation between variables for the alternative hypothesis. If the KMO and Barlett test has given the right conclusions, then factor analysis is carried out. Therefore, the principal's training in leadership becomes an important variable in the implementation of strategic leadership (Wiryadi, 2016).

Confirmatory Factor Analysis is a method of multivariate analysis that can be used to confirm the measurement model built following the hypothesis (Abu-Samaha & Shishakly, 2008).

In confirmatory factor analysis, there are latent variables and indicator variables. Latent variables are variables that cannot be established and constructed directly, while indicator variables are variables that can be observed and measured directly. The basic principlele of factor analysis is to extract a number of common factors from the original set of variables, so that: a. The number of factors is less than the number of original variables X. b. Most of the information (variety) of the original variable X, is stored in a number of factors. One of the objectives of factor analysis is to reduce many variables by grouping variables. In factor analysis, the variables are grouped based on their correlation. Variables with a high correlation will be in a certain group forming a factor, while variables in other groups have a relatively small correlation. Factor analysis is carried out to obtain a small number of factors that have the characteristics of being able to explain the diversity, the existence of factor freedom, and each factor can be explained clearly.

The steps of factor analysis in this study begin with calculating the correlation matrix to determine the adequacy requirements for the data in factor analysis. After finding the data adequacy requirements, the next step is to look for factors to explain the correlation between the indicators studied. The third step is factor rotation, which is looking for factors which potentially optimize the correlation between the observed independent indicators. This step is carried out if the variables in the formed factors have not provided a real explanation or have not been able to determine their membership. According to Suliyanto (2005), because the main principle of factor analysis is a correlation, the assumptions of factor analysis are closely related to the following correlations: 1) The correlation or linkage between variables must be strong 2) The index of comparison of the distance between the correlation coefficient and the partial correlation coefficient as a whole must be small, 3) In some cases, each variable to be analysed by factor analysis must be normally distributed.

Factor analysis is also used to determine the dominant factor in explaining a problem. The concepts that need to be considered before conducting factor analysis are variables, factors, loading factor, communality, rotation, extraction, and eigenvalue. Factors are several variables that measure the same indicator. These factors form a linearly independent set of variables, which means that no factor is a linear combination of other factors. This is because these factors are made independent of each other. There are two kinds of factors in factor analysis, namely common factors that cannot be observed directly and unique factors that are not explained by common factors. The common factor has more than one variable with a non-zero factor loading (coefficient value) associated with the factor, while the unique factor only has one variable with a non-zero factor loading associated with the factor. Common factors are always considered uncorrelated with unique factors, but common factors correlate with each other. 27 The factor analysis model uses the assumption that the initial set of variables is composed of two kinds of factors.

Factor analysis as a statistical method was used to prove the validity and reliability of the scale instrument. Factor analysis plays an important role in validating the instrument (Dimitrov, 2012; Setiawan et al., 2021; Aman, 2019). Azwar (2011) added that factor analysis is a statistical procedure commonly used to develop and analyze the relationship between variables of an instrument. In addition, factor analysis has been widely used in scale development research and it is a flexible statistical procedure and is used by researchers in various ways (Kahn, 2006; Mvududu & Sink, 2013). Becoming a researcher is not easy, it requires broad insight, a desire to always learn, be critical, and have a high curiosity (Zhao, 2010; Yanti, 2013; Fadli et al., 2021). In this article, the researchers will discuss one way to test measuring instruments in research, namely Confirmatory Factor Analysis.

Hair et al (2010) suggested that Confirmatory Factor Analysis (CFA) is part of SEM (Structural Equation Modeling) to test the way a measured variable or indicator is fine in describing or representing a number of a factor. In CFA factors are also known as constructs. Measurement theory is used to determine how variables are measured, systematically, and logically describe a construct that is displayed in a model (Fanami, 2014). Ghozali (2005) suggests that Confirmatory Factor Analysis is a method of multivariate analysis used to test or confirm the hypothesized model. The hypothesized model consists of one or more latent variables, which are measured by one or more indicator variables. Latent variables are variables that cannot be measured or cannot be measured directly and require an indicator variable to measure them,

while indicator variables are variables that can be measured directly. Measuring the size of the coefficient of validity can be seen as the size of the factor load price (λ). The greater the price, the more valid the indicator is said to be. The size to find out how much is said to be valid can use the t-value test.

CONCLUSION

Based on the results of the discussion above, it shows that both the sample of teachers, principals, and students obtained the KMO score (> 0.5) where the KMO value indicates the suitability of the sample, which means that the factors have a very significant correlation. Anti-Images Matrix in this study is used to see if there are factors that should not be included in the factor analysis because they have a very small level of significance. The results of the analysis of the MSA (Measure of Sampling Adequacy) show conformity to the normal threshold, so with these results, all question items or statements are used. The value communalities as the value of variance explained by the factors formed for each research variable also show the appropriate score. The matrix component shows how much the indicator/item probably influence the research variables. The indicator that has the greatest influence on the research variables is the one with the largest matrix component value, and the data shows that all the matrix components have met the statistical requirements. Eigenvalue is the amount of variance described by each factor, and only eigenvalues above 1 are included in the model, then all variances have eigenvalues above 1 which indicates that the eigenvalues are appropriate. The loading factor for all variables is above 0.40, and all factors on the training leadership instrument for the principals of Vocational High School have an AVE value greater than 0.5, thus meeting the reliability and can be accepted. A high AVE value indicates that the indicators have well represented the developed variables and are accepted if they are greater than 0.5.

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