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Confirmatory Factor Analysis (CFA) of School Capacity Barriers in the Teaching Process in Elementary Schools

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Abstract

The purpose of this study is to determine the factors that hinder school capacity in teaching. This study uses a quantitative approach to determine the factors that determine the Barriers to Teaching in Schools. The data analysis method in this study is confirmatory factor analysis (CFA). The data of this study were processed using the JASP program (Jeffrey's Amazing Statistics Program). The type of data collected was the results of PISA 2018. This study used primary data with a number of respondents of 50 schools. The results show that the fit of all models is acceptable. It can be concluded that P1, P2, Q1, and Q2 are the barriers to school capacity for teaching.

Keywords: *Capacity, Schooling, Teaching.*

PRELIMINARY

Education is a process to increase, improve, change knowledge, skills and attitudes, as well as the behavior of a person or group in an effort to make human life more intelligent through guidance, teaching and training activities (Nisoh, 2019; Al Fatha, et.al., 2023). The educational process shows the existence of active activities or actions and dynamic interactions that are carried out consciously in an effort to achieve goals (Widodo, et.al., 2021). So, it can be interpreted that education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual strength, self-control, personality, intelligence, noble morals, and the skills or abilities needed by themselves and society (Putnarubun, et.al.., 2021).

One of the important challenges faced by schools and universities is how to manage education to produce qualified and knowledgeable graduates, because knowledge plays an important role in human civilization (Djollong & Akbar, 2019). Education is a force that can change a civilization and determine the future of a nation (Damanik, 2022). Capacity can be defined as human ability, intuitive/institutional ability, and system capacity (Firman et al., 2023). Capacity development in education is a process that can improve the ability of teachers or principals to achieve the goals set by the school (Nisoh, 2019). School capacity development is the ability of individual organizational systems to carry out their functions properly, effectively and efficiently (Haq et al., 2025; Indar et al., 2024; Yusuf, 2020).

It is further explained that this capacity development is an ability to organize or carry out various functions, solve existing problems or issues, and design and formulate the goals to be achieved in developing a variety of strategies to increase the efficiency and effectiveness of school development (Ramadhani, et.al., 2021). Capacity development refers to the process by which individuals, groups, organizations, institutions, and communities develop their abilities, both individually and collectively, to be able to carry out their functions, solve their problems, and achieve their goals independently. As stakeholders and school communities, in terms of developing school capacity, the role of the principal, teachers, employees, and students must be able to realize the implementation of school capacity

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development, especially in terms of carrying out tasks and responsibilities properly in accordance with established plans (Dewi & Wibowo, 2020; Mande & Supriadi, 2024; Rachmawati et al., 2022; Samsudin et al., 2020).

Previous research conducted by Sumintono stated that the importance of the school's capacity to interpret this policy makes the school receive quality recognition from the central government as a superior school, and at the same time the school can collect additional funds from parents in large amounts (Sumintono, 2013). Another study conducted by Zulfa, Noor, and Riwabanto found that the educational services at SDLBN Kedungkandang were good, based on service methods, facilities and infrastructure, and human resources. Furthermore, institutional capacity development, based on its organizational structure, has been developed following the implementation of School-Based Management (SBM) (Zulfa dkk., t.t.). Based on this explanation, the author is interested in knowing the barriers to school capacity in teaching by using confirmatory factor analysis.

METHOD

This study uses a quantitative approach. The data analysis method used in this study is confirmatory factor analysis (CFA). Confirmatory factor analysis is a multivariate analysis method that can be used to test or confirm a hypothesized model (Sari, et.al., 2017). The data for this study was processed using JASP (Jeffrey's Amazing Statistics Program). The data collected were the results of the 2018 PISA test. This study used primary data from 50 schools.

Table 1. Instruments for measuring barriers to school capacity in teaching

P1	Lack of teaching staff
P2	Inadequate or underqualified teaching staff.
Q1	Kurangnya staf pembantu
Q2	Inadequate or poorly qualified support staff.

FINDINGS AND DISCUSSION

The results of the research analysis were carried out using PISA 2018 data. A total of 50 complete questionnaires were filled in by respondents and then analyzed. The results of research on School Capacity Barriers in Teaching are based on results from Confirmatory Factor Analysis (CFA). Next, the model fit results are obtained.

Table 2. *Model fit*

Model	X^2	df	P
Baseline Model	164.852	6	
Factor Model	9.224	1	0.002

The chi-square test is used to compare data with the model. Table 2 shows that the chi-square value is <3, indicating that the chi-square model has good model fit. The model fit index is <3 and <5. This indicates that the chi-square test has good model fit.

Table 3. *Additional fit measures*

Fit indices	
Index	**Value**
Comparative Fit Index (CFI)	0.948
Tucker-Lewis Index (TLI)	0.689
Bentler-Bonett Non-normed Fit Index (NNFI)	0.689
Bentler-Bonett Normed Fit Index (NFI)	0.944
Parsimony Normed Fit Index (PNFI)	0.657
Bollen's Relative Fit Index (RFI)	0.664
Bollen's Incremental Fit Index (IFI)	0.950
Relative Noncentrality Index (RNI)	0.948

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Table 3 shows that all parameters have been met/the model has fit, with no significant differences between the ideal model and the proposed model. The CFI = 0.94, NFI = 0.94, IFI = 0.95, and RNI = 0.94 also meet the criteria applied to obtain a fit model. Thus, this indicates that the model is fit, meaning the proposed model is fit because it is supported by the data and is acceptable.

Table 4. *Other fit measures*

Metric	Value
Root mean square error of approximation (RMSEA)	0.410
RMSEA 90% CI lower bound	0.199
RMSEA 90% CI upper bound	0.669
RMSEA p-value	0.004
Standardized root mean square residual (SRMR)	0.039
Hoelter's critical N (α = .05)	21.406
Hoelter's critical N (α = .01)	36.245
Goodness of fit index (GFI)	0.921
McDonald fit index (MFI)	0.920
Expected cross validation index (ECVI)	0.556

Table 5. Coefficient of Determination

R-Squared	
	R^2
P1	0.736
P2	0.748
Q1	0.619
Q2	0.933

R-squared is a number ranging from 0 to 1, indicating how much the combination of independent variables collectively influences the value of the dependent variable. R-squared is used to test the measured statistic. The closer it is to 1, the better the item's contribution. The R2 values obtained are all close to 1, thus improving the results.

Table 6. Parameter estimates

Factor loadings									
							95% Confidence Interval		
Factor	**Indicator**	**Symbol**	**Estimate**	**Std. Error**	**z-value**	**p**	**Lower**	**Upper**	**Std. Est. (all)**
Lack of teaching staff	P1	λ11	1.456	0.198	7.362	< .001	1.068	1.844	0.858
	P2	λ12	1.708	0.229	7.447	< .001	1.258	2.157	0.865
Lack of support staff	Q1	λ21	1.492	0.230	6.493	< .001	1.042	1.942	0.787
	Q2	λ22	1.602	0.180	8.906	< .001	1.249	1.954	0.966

In the table λ11 means loading factor, factor number 1 item number 2. λ12 means loading factor number 1 item number 2. λ21 means loading factor, factor number 2 item number 1. λ22 means loading factor, factor number 2 item no 2. Estimate means unstandardized coefficient, serves to determine its role is significant or not. P value indicates that it is significant which means it contributes well to the plan. The results show that the Std Est used is on average > 0.5, the data shows that all standard dimensions are on

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average above > 0.5, the higher the Std. Est is closer to 1 so that it shows the better functioning of the contribution of the item items.

Table 7. Factor variances

Factor variances							
					95% Confidence Interval		
Factor	**Estimate**	**Std. Error**	**z-value**	**p**	**Lower**	**Upper**	**Std. Est. (all)**
Lack of teaching staff	1.000	0.000			1.000	1.000	1.000
Lack of support staff	1.000	0.000			1.000	1.000	1.000

Table 7 shows that the factor variance indicates that increasing factor loading values indicate a better fit to the existing data. Next, we will explain the correlation between one dimension and another, as can be seen in Table 8.

Table 8. Residual variances

Residual variances							
					95% Confidence Interval		
Indicator	Estimate	Std. Error	z-Value	P	Lower	Upper	Std. Est. (all)
P1	0.759	0.201	3.772	< .001	0.365	1.153	0.264
P2	0.984	0.268	3.677	< .001	0.459	1.508	0.252
Q1	1.371	0.309	4.439	< .001	0.766	1.977	0.381
Q2	0.184	0.162	1.135	0.257	-0.134	0.501	0.067

The residual variance serves to indicate the error, as seen in the Std Error P1 0.26, Std error in P2 0.25, Std error in Q1 0.37, Std error in Q2 0.18. The increase in the indicator loading value indicates that the existing data is increasingly fit. Further details are explained in the image below.

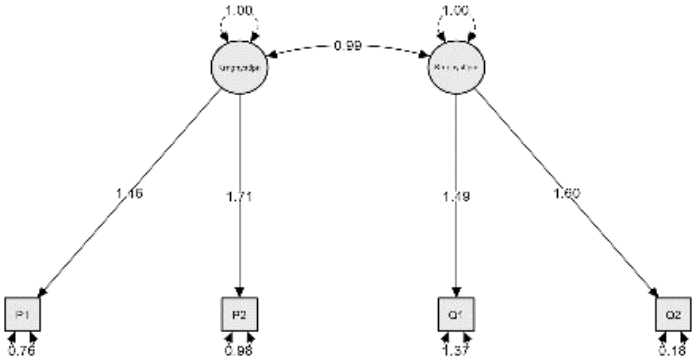

Figure 1. Data Indicator Loading Value.

CONCLUSION

Based on the analysis results, all indicators indicate that the model has a good and acceptable fit. This is indicated by goodness-of-fit values that meet the criteria, namely CFI = 0.94; NFI = 0.94; IFI = 0.95; and RNI = 0.94. Thus, the proposed model is declared fit, as it is supported by adequate empirical data. In addition, factors P1, P2, Q1, and Q2 were identified as the main barriers to school capacity in supporting the teaching process. These findings confirm that the constructed model is relevant and valid in explaining school capacity constraints in the learning context.

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