Spatial Analysis of Provincial Primary School Graduation Rates in Indonesia in 2023

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Abstract
classrooms (X2) as independent variables. A total of 34 samples were used, collected as secondary data from various Indonesian provinces during 2023-2024, accessed from the official website of the Ministry of Education, Culture, Research, and Technology. The results indicate that X1 is not significant (p-value=0.103), while X2 is significant (p-value=0.001) for the number of primary school graduates, indicating the significant influence of X2. The research findings suggest that the variable of the number of certified teachers (X1) does not significantly affect the number of primary school graduates. Conversely, the variable representing good classroom conditions (X2) is proven to significantly influence the number of primary school graduates. The policy recommendation is for the government and related institutions to prioritize the improvement and enhancement of school infrastructure, including conducive learning facilities and environments

Keywords: *Basic Education; Elementary School; Spatial analysis;*

INTRODUCTION

Basic education is the basis of further education and has an important role in improving a person's quality of life(Agata, 2024). The elementary school graduation rate is an important indicator that shows the quality of education in an area. Indonesia, as the country with the largest population in Asia, has significant challenges in increasing primary school graduation rates(Harwanti & Rumiati, 2020). In recent years, primary school graduation rates in Indonesia have remained low, with an average of around 80%. This is a very serious problem because it can impact the ability of Indonesian people to improve their quality of life and contribute to national economic growth.

Primary school graduation rates in Indonesia are influenced by various factors, including physical environmental factors, social factors, and economic factors. Physical environmental factors such as altitude, vegetation density, and rainfall can influence environmental quality which can affect the quality of education(Pakaya, et al., 2021). Social factors such as parental education, social status, and level of community participation can influence learning motivation and people's awareness of the importance of education. Economic factors such as income level, poverty level, and access to educational facilities can influence people's ability to access quality education(Kasa, et al., 2022).

In recent years, several studies have been conducted to determine the factors that influence elementary school graduation rates in Indonesia. However, much research still needs to be done to further understand how these factors influence primary school graduation rates in Indonesia. Therefore, this research aims to analyze the factors that influence elementary school graduation rates in Indonesia using a spatial approach. By using data from various provinces in Indonesia, this research will try to find out how physical, social and economic environmental factors influence elementary school graduation rates in Indonesia. It is hoped that the results of this research can help the government and educational institutions in developing more effective strategies to increase primary school graduation rates in Indonesia.

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LITERATURE REVIEW

A. Spatial Regression

Spatial regression analysis is an analysis method designed to understand the relationship between dependent and independent variables by considering spatial influences between observations(Puspita & Wutsqa, 2023). The spatial regression model has the following general form:

$$Y = \rho Wy + X\beta + u \quad (1)$$

$Y$is a vector of dependent variables of size , is a spatial lag coefficient parameter that describes the spatial influence between the dependent variables between observations. The spatial lag weighting matrix describes the spatial relationship

between each pair of observations. is a vector of independent variables of size , with the parameter vector being the regression coefficient that connects the independent variable with the dependent variable. Parameters are spatial coefficients for error.$n \times 1 \rho W n \times n \, X n \times k \beta u$

Before designing spatial regression, it is important to carry out an analysis of the possibility of spatial effects. One method commonly used to measure overall spatial autocorrelation is the Moran Index(Mailanda, et al., 2022). This method can help identify spatial patterns, whether there is an organized spatial structure or spatial randomness. There are ways to calculate spatial autocorrelation using the Moran Index:

$$I = \frac{n \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} \left(x_j - \bar{x}\right)\left(x_j - \bar{x}\right)}{\sum_{i=1}^{n} (x_i - \bar{x})^2}$$

Hypothesis testing for the Moran Index can be formulated as follows(Agustina, et al., 2022):

H_0: There is no Spatial autocorrelation

H_1: There is Spatial autocorrelation

The decision is rejected if the significant level is obtained by the 1st quantile of the standard normal distribution function.$H_0 \; \alpha |Z(I)| > Z_{1-\alpha} Z_{1-\alpha}(1-\alpha)$

B. Definition of Basic Education

Basic education, especially elementary school (SD), is an important foundation for the development of students in their journey in the world of education. As an initial level of education, elementary school has a central role in shaping students' knowledge, skills and attitudes which will become an important basis for their future education. The quality of learning in elementary schools is an important key in ensuring that every student has the same opportunity to develop their potential optimally. Therefore, the implementation of learning in elementary schools must be carried out with high optimality(Cahyani, et al., 2021).

This includes providing adequate educational resources, using effective teaching methods, fostering a conducive learning environment, as well as active involvement from educators and other educational stakeholders.(Rifly, 2023). Through a quality learning approach in elementary school, it is hoped that every student can gain solid knowledge and relevant skills that will help them succeed in their educational journey and in everyday life. Thus, elementary school plays an important role in preparing future generations who are skilled, knowledgeable and highly competitive.

RESEARCH METHOD

A. Type and source of data

The data analyzed in this research involves (2) a number of variables, namely:

Table 1. Description of research variables

Variable	Type	Total Sample
Number of Elementary School Graduates (Y)	Dependent	34
Number of Elementary School Certified Teachers (X1)	Independent	34
Elementary School Good Condition Classroom (X2)	Independent	34

Table 1servedescription of the research variables used in the analysis. Observed variables include the number of elementary school graduates (Y) which acts as the dependent variable, as well as the number of certified elementary school teachers (X1) and good classroom conditions in elementary school (X2) which act as independent variables. The total number of samples used in this research is 34. Variable Y (number of elementary school

graduates) is the variable that wants to be predicted or explained in the analysis, while variables X1 (number of elementary school certified teachers) and X2 (good condition elementary school classrooms) are independent variables that used to explain variation in the dependent variable. Thus, this study aims to investigate the relationship between the number of elementary school graduates, the number of certified elementary school teachers and classroom conditions in elementary schools.

The data used in this research is secondary data collected based on research variables from various provinces in Indonesia during the 2023-2024 period. This data was obtained from the official website of the Ministry of Education, Culture, Research and Technology which can be accessed via the link https://publikasi.data.kemdikbud.go.id/.

B. Research Stages

In this research, data analysis was carried out to determine the level of suitability of educational facilities in Indonesia through cluster analysis based on the following steps:

1. Collecting datafrom the official website of the Ministry of Education, Culture, Research and Technology
2. Perform Descriptive analysis
3. Carry out Spatial Effect testing using equation (2).
4. Forming spatial regression using equation (1)
5. Interpretation of results

RESULTS AND DISCUSSION

A. Descriptive Analysis

Descriptive analysis was carried out to provide a comprehensive picture of the educational data that had been collected. By using descriptive statistics, researchers can identify the main characteristics of educational data, which play a role in increasing understanding of educational conditions and emerging trends. The results of this descriptive analysis are presented in the following visualization:

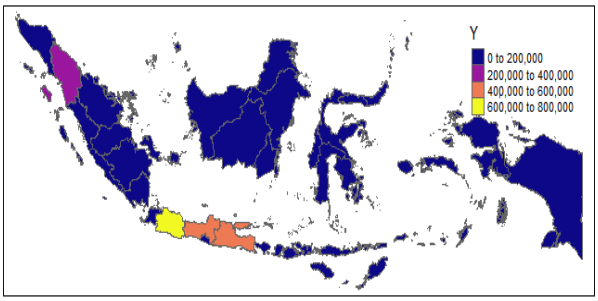

Figure 1. Descriptive Analysis of the Number of Elementary School Graduates in Indonesia 2023 - 2024

Figure 1 depicts the distribution of the number of elementary school graduates in various provinces in Indonesia. From this figure, it can be observed that West Java Province shows the highest number of elementary school graduates, which is in the range of 600,000 to 800,000 graduates. This shows that West Java had a significant number of elementary school graduates in the observed time period. On the other hand, there are other provinces such as Central Java and East Java which also show quite large numbers of elementary school graduates, although not as large as West Java. These provinces may have large populations or focus on increasing access to basic education.

However, it is important to note that most provinces in Indonesia show relatively low numbers of elementary school graduates. This may reflect challenges in efforts to improve access and quality of basic education in some areas, especially in rural or remote areas. Factors such as lack of adequate educational facilities, availability of trained teachers, and awareness of the importance of education can influence student participation and graduation rates from basic education.

B. Spatial Effect Test

In the following section, spatial effects will be tested to evaluate the correlation between provinces in Indonesia. The test results will be presented in the following table.

Table 2. Moran Index Test Statistics

Parameter	Mark
Moran I	3.2441
P-Value	0.000589

Table 2 presents the results of the Moran index test for the observed data. It was found that the Moran index (Moran I) value was 3.2441, while the p-value related to the test was 0.000589. A very low p-value indicates strong evidence to reject the null hypothesis, which states the existence of spatial autocorrelation. Thus, these results indicate that there is significant evidence for the existence of positive spatial autocorrelation in the data.

C. Spatial Regression

In the following subchapter, spatial regression will be carried out to determine the relationship between independent and dependent variables. The mathematical equation is shown as follows:

$$Y = -10009.74 - 0.10\rho + 3.01X1 + 7.0 \quad (3)$$

Using equation 3, the significance of each independent variable is tested as shown below:

Table 3. Significance Test

Variable	Description	p-value
X1	Certified Teacher	0.103
X2	Classrooms are in good condition	0.001

Based on Table 3, a significance test was carried out for each independent variable on the number of elementary school graduates, which is the dependent variable. The results show that variable X1, which is the number of certified teachers, has a p-value of 0.103. This shows that there is not enough statistical evidence to reject the null hypothesis that variable X1 does not have a significant effect on the number of elementary school graduates. However, the variable X2, which describes good classroom conditions, has a very low p-value, namely 0.001. This shows that there is strong statistical evidence to reject the null hypothesis that variable X2 does not have a significant influence on the number of elementary school graduates. Thus, variable X2 has a significant influence on the number of elementary school graduates, while variable X1 does not have a significant influence in this context.

D. Policy Recommendations

Based on the results discussed previously, thengovernmentand related institutions must focus on repairing and enhancing school infrastructure, including facilities and a conducive learning environment. This is because good classroom conditions have been proven to have a significant influence on the number of elementary school graduates.

CONCLUSIONS AND RECOMMENDATIONS

A. **Conclusion**

Based on the research results, the researcher concluded that the variable number of certified teachers (X1) did not have a significant influence on the number of elementary school graduates. On the other hand, the variable that describes good classroom conditions (X2) is proven to have a significant influence on the number of elementary school graduates. The policy recommendation given is for the government and related institutions to prioritize repairing and enhancing school infrastructure, including facilities and a conducive learning environment.

B. Suggestion

It is recommended that further research take additional steps to deepen understanding of the factors that influence the number of elementary school graduates. First, research could consider developing additional variables that could play a role in determining elementary school graduation rates, such as the quality of teaching or the level of parental participation in their children's education. In addition, more in-depth analysis can be carried out to understand more complex relationships between the variables that have been considered in this study. More complex analytical methods and case studies in different regions or schools can also provide richer insight into local dynamics that influence the number of elementary school graduates. Finally, the development of more comprehensive predictive models can help in

formulating more effective education policies by considering various relevant factors holistically. By taking these steps, future research can make a greater contribution to improving our understanding of the factors that influence the number of elementary school graduates and designing more effective policy interventions in the field of basic education.

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