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Human Development Index and Junior Secondary National Exam Scores in Indonesia

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Abstract
This study analyzes the correlation between the average results of the national junior high school exam and the achievement of the Human Development Index (HDI), which is oriented towards formal education indicators, including expectations and average length of schooling. Although the role of education is recognized, the underlying empirical studies are still minimal. This linear regression research examines the influence of literacy access, student-teacher ratio, and educational participation. Data sources come from 440 districts/cities in Indonesia in 2009. The analysis approach meets the applicable goodness-of-fit standards through the R^2, ANOVA, and t-test. The study's results indicate that the range of registrants, participation, and number of teachers greatly affect the results of the national exam and the Human Development Index. The increase in higher scores has been proven to affect efforts to improve educational standards and human development outcomes. This study's results present a strong empirical foundation for developing data-driven education policies to strengthen sustainable development in Indonesia. The findings underscore the importance of investing in educational resources and infrastructure to enhance student performance and overall human development. Policymakers can use these insights to allocate funds more effectively, focusing on increasing teacher recruitment, improving student participation rates, and expanding access to educational opportunities. Furthermore, the study's results can serve as a blueprint for other developing nations seeking to improve their education systems and human development indices through data-driven decision-making.

Keywords: Human Development Index (HDI), Educational Achievement, Regional Disparities

INTRODUCTION

Average National Exam Score Junior Secondary Level can contribute to an increase in Indonesia's Human Development Index (HDI), especially in the "expected years of schooling" and "mean years of schooling" components. HDI is an important international indicator that assesses a nation's well-being and measures its progress. (Urzúa & Vilbert, 2024). According to Rajagukguk et al (2021), the achievement of an educational program can be measured based on the average score of the national exam (Herman et al., 2023). This research is intended to address the gap by applying a linear regression approach to provide a valid basis for education. It must be admitted that the direct link between the results of these tests and the human development index is rarely analyzed.

However, although there has been research that makes a connection between education and the human development index, there have not been many studies that directly measure the numerical influence of the achievement of junior high school exam scores on the human development index, as expected in the Indonesian context. Most previous research has focused on various aspects of macroeconomics or the level of national education. The lack of valid data and measurable evidence hinders the formulation of effective and consistent implementation of education policies to support sustainable human development goals. Thus, a quantitative model that integrates academic achievement and socio-economic indicators is needed to address these shortcomings.

There is a high correlation between scientific competence in junior high school children and the development of resources for global competition. Basic education significantly affects human resource outcomes, transformation, and economic growth. Even according to Agasisti & Bertoletti (2022) The number of universities will increase if an area has a strong economy. Globally, education interacts with economic growth and has a complex impact on health, population, and the environment. (Bu & Ali, 2022). In the Indonesian context, there is a strong relationship between the government's budget

allocation in the education sector and economic growth, as it is decided that 20% of the state budget is allocated to the education sector. (Suwandaru, Alghamdi, & Nurwanto, 2021). However, the economic relationships and educational outcomes relevant to the progress of the human development index have not been adequately studied.

The high average score achievement level for junior high school children can indicate equitable access and quality of education. If this is achieved, the polarization between groups, the risk of social conflict, and marginalization can be adequately overcome. The level of social inequality and educational relationships, the cost-benefits, and the risk of dropping out of school are very influential. (Müller & Klein, 2023). The population's average income is one of the most significant factors affecting the relationship between resource reallocation and the health, economic, and education dimensions. (Claveria, 2024b). There is a strengthening of social sensitivity regarding income disparity. (Claveria, 2024a). A Practical assessment of measurable outcomes between educational activities and the various broad factors is necessary.

The high quality of junior secondary education is an essential foundation for a knowledge-based economy, where innovation, technology, and intellectual capabilities are the main drivers of the national economy. The knowledge base is the economy's primary driver, and this method is the main point in maintaining a country's economy. (Siddiqui & Afzal, 2022). It requires conceptualization, specifically the result of a knowledge-based economy, such as the global education area, that provides financial benefits for education sector entrepreneurs. (Rottleb & Kleibert, 2022)For this reason, the transformation from an industrial economy to a knowledge-based economy is recognized as the primary function of humans in expanding into different sectors. (Mohamed, Ari, Al-Sada, & Koç, 2021). The quality and quantity of public education are legitimately recognized as a way to deal with the changing skills needs of economic actors who are increasingly knowledge-based (*Stimulating Economic Growth through Knowledge-Based Investment*, 2013). Knowledge-based economics needs to be analyzed in terms of its advantages, weaknesses, and potential to reap greater benefits in the future (Ben Hassen, 2022). However, little research assesses this usefulness in measurable economic terminology, especially when optimizing the general budget with the efficiency of education costs.

There are enormous benefits if the average score of junior high school students is high: it lowers the number of class stays, addresses the risk of dropping out of school, reduces the cost of additional classes, and most importantly, reduces the cost of education per capita. All of this reduces the burden on the government and can divert the budget to other areas in the context of the progress of education itself. The advantages and disadvantages of education efficiency in a country will easily encourage the allocation of funds in the field of education and worker resources. (Chen, Yu, Addis, & Guo, 2022). Educational institutions will be more independent, and people's expectations will be more relevant, timely, and appropriate (Godonoga & Sporn, 2023). The dynamics of global economic development will describe the renewal of national characteristics in attitudes and behaviors of prudence, obtaining education, and its application in the local and international environment. (Zhang, 2021)On the other hand, the research practically seeks to model the relationship between teacher capability, institutional factors, and academic achievement, and the human development index.

In particular, high average scores of junior high school children show significant academic achievement. This can be an indicator of improving the quality of basic education. Therefore, good quality education is a medium for social and individual improvement. (Derkong-Dery & Agbley, 2021). Thus, teachers are responsible for planning and developing learning platforms to optimize students' achievement and welfare. (Jiang, Wijaya, Mailizar, Zulfah, & Astuti, 2022). The percentage of teachers with a high chance is recognized as highly skilled in designing and evaluating learning formats and designs. (Khan & Krell, 2019). Teachers perform a strategic function in implementing and promoting new findings throughout educational programs (Nida, Mustikasari, & Eilks, 2021; Herman et al., 2022). Although access to electricity has been linked to educational outcomes, few studies still attempt to integrate the progress of educational performance with socioeconomic variables, especially with a linear regression approach.

The quality of basic education is also greatly influenced by external factors such as household access to electricity, which is proven to increase the effectiveness of student learning. Access to electricity

for families is urgently needed for both educational and health needs (Kunieda, Manzo, Subramanian, & Jimba, 2022)Practically, a small percentage of people with access to electricity indicates a high poverty rate, and there is a direct and significant relationship with education. (Kelly, Toukap Yimele, Wassou Tchieu, & Rutazihana, 2023). According to Buyinza & Kapeller (n.d.) There are findings that electrification makes school enrollment very significant for all fields of education. Furthermore, the benefits of household access to electricity increase the percentage of the education level. However, it is undeniable that there is a gap in supporting the policy proportionately. Children's educational achievement level is greatly influenced by electrification in the family. This motivates parents to register their children in school (Kumar & Rauniyar, 2018)electrification has positive and significant effects on household income and expenditures and school enrollment. The real positive effects in these aspects are family income and expenses and children's school enrollment. (Dasso, Fernandez, & Ñopo, 2015)

It must be admitted that much research on the quality of education is influenced by a variety of factors (Rajagukguk et al., n.d.) However, this research with a quantitative approach seeks to integrate and analyze how family access factors, the number of students, and the number of teachers at the junior high school level contribute very positively to the increase in test scores and have implications for the Human Development Index, especially in Indonesia. This gap limits the ability to formulate precise, evidence-based education policies aligned with national development goals. The results of these observations provide a contribution that can be further developed by the authorities to maximize education funds, advance equality, and the quality of education itself.

This research was carried out to answer this problem using a linear regression approach that includes various variables. The goal is for a comprehensive analysis to provide a more reliable picture and be used to design basic education to improve the human development index. This study seeks to overcome the problem through a linear regression approach to modeling various influencing variables, thereby making a data-driven contribution to improving education.

RESEARCH METHODS

The data in this study is sourced from the World Bank, Indodapoer, for 440 districts and cities in Indonesia. This data is the Average National Test Score: Junior High School Level (out of 100, available only at the district level for 2009).

The description of this statistic shows the following: Number of Teachers: Junior High School Level (in number of people, 2009 data only), Number of Students: Junior High School Level (in number of people, 2009 data only), Pure Participation Ratio: Junior High School (in %), and Household Access to Electricity: Total (in % of total households).

This table presents descriptive statistics based on five junior high school education variables in Indonesia, namely the number of observations (N), minimum, maximum, average, and standard deviation. The average Junior High School National Exam score is 7,159.08 (min: 6,001; max: 8,384; SD: 458.19) out of 440 observations. Household access to electricity is also high, averaging 8,470.6 (min: 42; max: 10,000; SD: 1,957.12) with the same number of observations. The average number of junior high school students is 42,698 (min: 100; max: 98,700; SD: 29,376.23) from 89 observations, the average participation rate of junior high school consisted of 6,562.81 (mean: 693; max: 9,147; max: 9,147; max: 9,147; SD: 1,174.12) from 440 observations. The number of junior high school teachers was recorded at an average of 50,421.99 (min: 500; max: 99,000; SD: 25,075.81) from 282 observations. The valid data listed and presented in a structured format were 79 observations.

Table1. Variable, N, Minimum, Maximum, Mean, and Standar Deviasi

	N	Min.	Max.	Mean	Std. Dev.
Average National Exam Score: Junior Secondary Level.	440	6001.00	8384.00	7159.0773	458.18640
Household Access to	440	42.00	10000.00	8470.6000	1957.11757

	N	Min.	Max.	Mean	Std. Dev.
Electricity.					
Number of Students: Junior Secondary Level.	89	100.00	98700.00	42697.7528	29376.23103
Net Enrollment Ratio: Junior Secondary.	440	693.00	9147.00	6562.8091	1174.11981
Number of Teachers: Junior Secondary Level.	282	500.00	99000.00	50421.9858	25075.80704
Valid N (listwise).	79				

Source: World Bank, Indodapoer (2025) (Authors' Calculation).

The model used in this study is linear multinomial regression.

$$Y = \alpha_0 + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 . X_3$$

Y = Average National Exam Score: Junior Secondary Level.
X1 Household Access to Electricity.
X2 Number of Students: Junior Secondary Level.
X3 Net Enrollment Ratio: Junior Secondary Level.
X4 Number of Teachers: Junior Secondary Level.

Table: 2

No	Bound Variables (Y)	Independent Variables (X)
	Average National Exam Score: Junior Secondary Level	
		Household Access to Electricity
		Number of Students: Junior Secondary Level
		Net Enrollment Ratio: Junior Secondary.
		Number of Teacher: Junior Secondary Level

The following figure illustrates that four independent variables (X) affect the bound variable (Y):

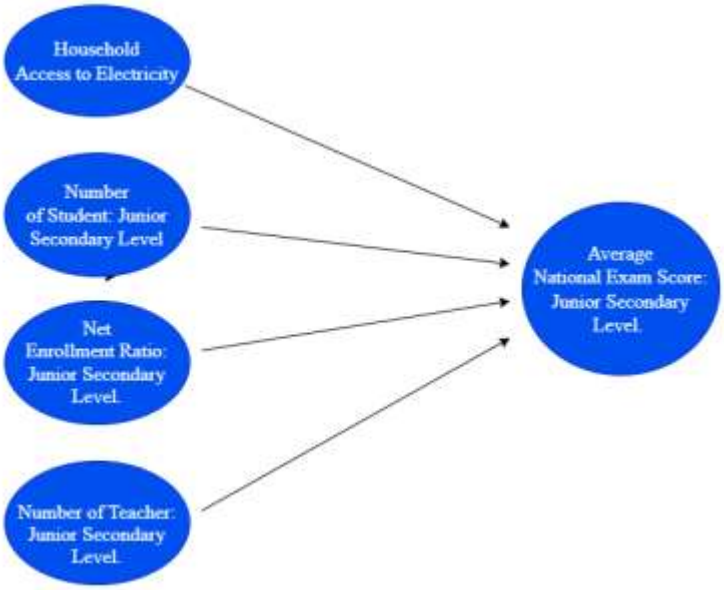

Figure 1. four independent variables (X) affect the bound variable (Y)

The data is used to derive values from the model parameters
The model used in the study is a model that fits the data:

1. According to the substance (the parameters)
2. Meet the goodness of fit test (at least meet the following three conditions).
   a. Large R2.
   b. Significant Anova test
   c. T-test, significant

RESULTS

The following is an analysis of the correct and valid multiple linear regression results based on the coefficient table, with dependent variables: Average Junior High School National Exam Score (maximum score of 100) at the district level in 2009:

Table 3. Coefficientsa
Model Unstandardized Coefficients Standardized Coefficients

Model	B	Std. Error	Beta	t	Sig.
(Constant)	61.859	1.262		49.009	.000
Household Access to Electricity.	.075	.014	.293	5.497	.000
Number of Student: Junior Secondary Level.	.000	.000	-.170	-3.027	.003
Net Enrollment Ratio: Junior Secondary.	.043	.020	.109	2.203	.028
Number of Teacher: Junior Secondary Level.	.001	.000	.248	4.250	.000

Source : World Bank, Indodapoer (2025) (Authors' Calculation).

This linear regression model intends to examine the various components that affect the average score of the junior high school exam at the district/city level in Indonesia in 2009. The independent variables studied included: household access to electricity, number of junior high school students, pure junior high school participation rate, and number of junior high school teachers. Below are the results of the analysis for each coefficient:

1. Household access coefficient to electricity: 0.075 | Beta: 0.293 | p = 0.000. There was a positive and vital correlation between electricity availability and national test scores. For an increase in one unit of electricity access (the change in units per 10,000 households), it will add 0.075 points to the national average test score. This condition illustrates that each region is looking for more adequate electricity availability, with the potential to obtain a better level of achievement due to the availability of support for learning activities at home.

2. Coefficient of the number of junior high school students: -0.000 | Beta: -0.170 | p = 0.003 The number of students has a negative and important effect on exam scores. Although the coefficient is very low, the negative side illustrates that regions with larger student populations usually get smaller United Nations average scores. This may indicate an overload on the system or an inadequacy of facilities and infrastructure as per the number of students.

3. Junior High School pure participation rate coefficient (Net Enrollment Ratio): 0.043 | Beta: 0.109 | p = 0.028 There was a positive and important impact on the pure participation rate and UN score. A one-point increase in the pure participation rate would increase the average UN score by 0.043 points. This condition illustrates that an area with a larger student population has the potential to obtain better academic achievement.
4. Coefficient of the number of junior high school teachers: 0.001 | Beta: 0.248 | p = 0.000 The number of teachers positively affects and increases the UN score. An increase in one teacher was associated with an increase in the PBB average score of 0.001 points. Although overall low, the cumulative impact has a significant influence in the field of education, and shows that a proportionate number of teachers contributes significantly to improving the quality of education.

DISCUSSION

This study investigated the relationship between the Human Development Index (HDI) and Junior Secondary National Exam Scores across Indonesia, with the goal of understanding how regional disparities in human development may impact educational outcomes. The findings revealed a significant positive correlation between HDI and students' performance on the national exams. Provinces with higher HDI scores—characterized by better health, education, and income indicators—tended to report higher average exam scores. This supports the hypothesis that human development and educational achievement are closely intertwined.

One notable aspect of the findings is the consistent strength of the relationship across multiple years and subjects tested, suggesting that the impact of HDI is not limited to particular disciplines or short-term fluctuations. The education component of the HDI, which includes average years of schooling and expected years of schooling, appears to be a strong predictor of academic performance. Furthermore, provinces with higher life expectancy and income levels may provide more supportive environments for students, including better school facilities, qualified teachers, and access to learning resources.

Despite the overall trend, some provinces with moderate HDI scores performed better than expected, indicating that local educational policies and community engagement may play a compensating role in student achievement. This implies that while HDI is an important structural factor, it does not fully determine educational outcomes. Further qualitative research could explore how specific interventions, such as teacher training programs, local government support, or cultural attitudes toward education, contribute to outlier performance.

These results have important policy implications. Efforts to improve student performance on a national scale should not only focus on school-based reforms but also address broader human development challenges such as healthcare, poverty reduction, and adult education. A more integrated approach to development could yield long-term improvements in educational outcomes and overall societal well-being. Policymakers should consider aligning education policy with regional development initiatives to reduce disparities and ensure equitable learning opportunities for all Indonesian students.

CONCLUSION

This study illustrates that access to electricity, educational participation, and the number of teachers have a real influence on the improvement of national exam results and the Human Development Index. These findings reinforce the view that the significance of basic education is a determinant of human development. These recommendations emphasize the need to strengthen data-driven education policies, especially in regions with significant infrastructural challenges. Conceptually, this research makes a significant contribution that examines the interaction between education and development. In practical terms, this research offers a policy framework that serves as the basis for efficient and efficient policy formulation to accelerate the equitable distribution of education and sustainable development in Indonesia.

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