

HOW DOES INCOME INEQUALITY AFFECT ACADEMIC SUCCESS ACROSS COUNTRIES? EVALUATION OF PISA RESULTS

COMO A DESIGUALDADE DE RENDA AFETA O SUCESSO ACADÊMICO ENTRE OS PAÍSES? AVALIAÇÃO DOS RESULTADOS DO PISA

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ABSTRACT

The aim of the study is to compare whether there is a significant difference between the PISA exam averages of countries with the highest income inequality and countries with the lowest income inequality and to determine whether there is a significant relationship between income inequality and PISA success. The study group was selected from among the countries with the highest and lowest income inequality according to the GINI index using the contrast sampling technique, which is a purposive sampling technique. T-test, correlation and simple linear regression analyses were conducted on income inequality and PISA scores. The average PISA scores of the 12 countries with the highest income inequality and the 12 countries with the lowest income inequality were compared with the average scores of the same countries regarding income inequality. There is a significant difference between the average PISA scores of the countries with the highest and lowest income inequality. There is a significant and inverse relationship between income inequality and PISA success. While income inequality increases, PISA success decreases, while PISA success increases as income inequality decreases. According to the simple linear regression model, income inequality predicts PISA success significantly as the only independent variable. Income inequality is a determinant of students' academic success.

Keywords: Income Inequality, Academic Success, PISA Results, International Comparison.

RESUMO

O objetivo do estudo é comparar se há uma diferença significativa entre as médias do exame PISA dos países com maior desigualdade de renda e dos países com menor desigualdade de renda e determinar se há uma relação significativa entre a desigualdade de renda e o sucesso no PISA. O grupo de estudo foi selecionado entre os países com a maior e a menor desigualdade de renda, de acordo com o índice GINI, usando a técnica de amostragem por contraste, que é uma técnica de amostragem intencional. Foram realizadas análises de teste T, correlação e regressão linear simples sobre a desigualdade de renda e as pontuações do PISA. As pontuações médias do PISA dos 12 países com a maior desigualdade de renda e dos 12 países com a menor desigualdade de renda foram comparadas com as pontuações médias dos mesmos países em relação à desigualdade de renda. Há uma diferença significativa entre as pontuações médias do PISA dos países com a maior e a menor desigualdade de renda. Há uma relação significativa e inversa entre a desigualdade de renda e o sucesso no PISA. Quando a desigualdade de renda aumenta, o sucesso no PISA diminui, enquanto o sucesso no PISA aumenta à medida que a desigualdade de renda diminui. De acordo com o modelo de regressão linear simples, a desigualdade de renda prevê o sucesso no PISA de forma significativa como a única variável independente. A desigualdade de renda é um fator determinante do sucesso acadêmico dos alunos.

Palavras-chave: Desigualdade de renda, sucesso acadêmico, resultados do PISA, comparação internacional.

Introduction

Income inequality is the inequitable distribution of national income among individuals or social classes. A high per capita income in a country does not necessarily mean that the distribution of income in that country is fair. In many countries around the world, income inequality appears to be increasing (Hirsch, 2004), (Redmond & Kattuman, 2001). After 1980, the upper class, which received the largest share of world income, became increasingly richer (Hirsch, 2004). Among the most important causes of income inequality are tax injustice, high inflation, unemployment, public expenditures, high interest payments, polarization and anti-democratic government practices (Yaşar, 2016). The consequences of income inequality can be assessed from three perspectives: Psychosocial, social capital and neo-material perspectives (Hill & Jorgenson, 2018), (Jutz, 2015). From a psychosocial perspective, having a low social status can weaken people's self-control and make them feel excluded (Marmot, 2004). In terms of social capital, income inequality weakens social cohesion and solidarity, which may lead to a decrease in social support for schools. According to the neo-materialist view, material incomes are mostly exchanged among the elite of society, which has a more

negative impact on lower income groups (Hill & Jorgenson, 2018). The negative effects of income inequality can be observed on academic success. Income inequality negatively affects children's academic development. These negative impacts are reflected on students through school and environmental processes. Academic success is not a short-term variable and varies depending on children's social and economic status. Income inequality affects children and youth in terms of stress, avoidance of responsibility, low self-esteem, dropping out of school, low academic success and substance abuse (Olson, 2010), (Wilkinson & Pickett, 2010) Inequality in income distribution leads to inequality within schools and ultimately to inequality between schools (Green, 2009).

Inequality between schools can be assessed through academic success outcomes. The most widely accepted form of international assessment of academic success is the PISA test. Many countries participate in the PISA test to determine the knowledge and skill levels of their students, to compare the performance of their schools with schools in other countries and to develop success standards (Ministry, 2013). The PISA exam (Program for International Student Assessment) is a test administered by the OECD that measures the academic skills of 15-year-old students at three-year intervals. The main purpose of the PISA exam is to determine students' academic skill levels. For this reason, PISA exams measure the mathematics, science literacy and reading skills of fifteen-year-old students (Ministry, 2015).

Problem Status

In the literature, it is observed that studies showing the effect of income inequality on academic success are limited to the inner regions of some countries. According to the 2006 data of the PISA exam, it was found that mathematics success was higher among students from countries with lower income inequality (Condrón, 2011), (Chiu, 2010). According to PISA data from 2000-2015, there is a significant correlation between high income inequality and low success in math, science and reading (Thorson & Gearhart, 2018). Data from different states in the United States show that there is a significant relationship between income inequality and low academic success (Wilkinson & Pickett, 2010). Studies conducted in different states

in the United States of America at different times have shown that children from low-income families have lower academic success (Feinstein, 2006; Grossman, 2005; Haveman & Wolfe, 1984).

This study reveals the consequences of income inequality in terms of academic success in an international comparative perspective. The reason for focusing on academic success in this study is that students' academic success has a social and economic impact. In this context, the academic success of countries with high income inequality and countries with low income inequality were compared according to PISA results. It is assumed that the findings of this internationally comparative study in terms of income inequality will raise awareness on individuals and institutions that shape educational policies. The study sought answers to the following questions:

1. Is there a significant difference between countries' PISA scores in terms of income inequality?
2. Is there a significant relationship between the level of income inequality and PISA scores?
3. Is income inequality a significant predictor of PISA success?

Methodology

Research Model

This study is a relational survey modeled study in quantitative research method. Correlational survey is a research model that aims to determine the direction and degree of change between at least two or more variables simultaneously (Aypay, 2022).

Study Group

The countries in the study group were determined by the contrast sampling technique within the purposeful sampling method. The countries in the study group are categorized as 12 countries with the highest income inequality (*Colombia, Brazil, Panama, Mexico, Chile, Costa Rica, Peru, Dominic, Argentina, Malaysia, Turkey,*

Uruguay) 12 countries with the lowest income inequality (Croatia, Hungary, Netherlands, Iceland, Belgium, Finland, Norway, Denmark, Sweden, Slovakia, Czechia) and according to the GINI Index (GINI, 2024). Among the countries with the highest and lowest income inequality, only the countries participating in the PISA exams were included in the study group. The PISA test scores of these countries between 2006 and 2022 were obtained from the OECD database (OECD, 2024).

Table 1 – PISA Exams participated by the countries in the study group and Gini average values

Countries	2006 PISA	2009 PISA	2012 PISA	2015 PISA	2018 PISA	2022 PISA	Average Income Inequality GINI Index (1990-2020) *
Croatia	✓	✓	✓	✓	✓	✓	0.29
Hungary	✓	✓	✓	✓	✓	✓	0.29
Netherlands	✓	✓	✓	✓	✓	✓	0.28
Iceland	✓	✓	✓	✓	✓	✓	0.28
Belgium	✓	✓	✓	✓	✓	✓	0.28
Finland	✓	✓	✓	✓	✓	✓	0.27
Norway	✓	✓	✓	✓	✓	✓	0.27
Denmark	✓	✓	✓	✓	✓	✓	0.27
Sweden	✓	✓	✓	✓	✓	✓	0.27
Slovakia	✓	✓	✓	✓	✓	✓	0.26
Czechia	✓	✓	✓	✓	✓	✓	0.26
Slovenia	✓	✓	✓	✓	✓	✓	0.25
Colombia	✓	✓	✓	✓	✓	✓	0.54
Brazil	✓	✓	✓	✓	✓	✓	0.56
Panama	X	✓	X	X	✓	✓	0.54
Mexico	✓	✓	✓	✓	✓	✓	0.50
Chile	✓	✓	✓	✓	✓	✓	0.50
Costa Rica	X	X	✓	✓	✓	✓	0.48
Peru	X	✓	✓	✓	✓	✓	0.47
Dominic R.	X	X	X	✓	✓	✓	0.47
Argentina	✓	✓	✓	X	✓	✓	0.46
Malaysia	X	X	✓	X	✓	✓	0.45
Turkey	✓	✓	✓	✓	✓	✓	0.44
Uruguay	✓	✓	✓	✓	✓	✓	0.42

References: <https://data.worldbank.org/indicator/SI.POV.GINI?year=2023>

In Table 1, the PISA exams in which the countries with the highest income inequality and the countries with the lowest income inequality participated are indicated with (✓) and the years in which they did not participate are indicated with (x). Table 1 shows the average GINI index scores of the countries with the highest

and lowest income inequality (1990-2022). In countries with high income inequality, the GINI inequality value is high ($> .04$), while in countries with low income inequality, the GINI inequality value is low ($< .03$). In countries with income inequality coefficient below (0.3), it can be said that national income is shared more fairly among social classes.

Datat Collection Tool

The academic data in this study consist of the PISA scores of the countries in the study group (2006, 2009, 2012, 2015, 2018, 2022). Data on income inequality consist of income inequality scores in the GINI index (1990-2022) of the countries in the study group (GINI, 2024). The GINI coefficient was developed by Corrado Gini in 1912 with reference to the Lorenz curve. In this coefficient, income inequality is represented by a value between “0” and “1”. If the coefficient is close to 0, it means that income distribution is distributed absolutely equally among individuals, while if the coefficient is close to 1, it means that income distribution is distributed unequally.

Analysis of Data

As a result of the normality test performed in the SPSS 25 package program, it was determined that the mean PISA exam score averages (ShapiroWilk - Skewness (.075) $> .05$; Kurtosis (1.24) $> .05$ and the mean of the data on income inequality (ShapiroWilk - Skewness (.014) $> .05$; Kurtosis (1.06) $> .05$ were normally distributed. It was found appropriate to perform t-test, correlation and simple linear regression analyzes from parametric tests on normally distributed data.

Results

In the findings section, PISA score averages of countries with high and low income inequality, t-test for the comparison of PISA results in terms of income

inequality, correlation and regression test results between income inequality and PISA are shown.

Table 2 – PISA Averages of countries in the study group

PISA Results (2006-2009-2012-2015- 2018-2022)	Country	N	\bar{x}	SS
PISA (Math)	Countries with the Lowest Income Inequality	12	496.18	15.37
	Countries with the Highest Income Inequality	12	394.27	31.94
PISA (Science)	Countries with the Lowest Income Inequality	12	497.36	16.66
	Countries with the Highest Income Inequality	12	404.89	30.82
PISA (Read)	Countries with the Lowest Income Inequality	12	490.27	15.38
	Countries with the Highest Income Inequality	12	408.97	29.07
PISA (General)	Countries with the Lowest Income Inequality	12	494.60	14.67
	Countries with the Highest Income Inequality	12	402.71	29.41

The PISA Math exam average of countries with high income inequality (PISA 2006, 2009, 2012, 2015, 2018, 2022) is 394.27 points, while the PISA Math exam average of countries with low income inequality is higher with 496.18 points. While the PISA Science average of countries with high income inequality is 404.89 points, the PISA Science average of countries with low income inequality is higher with 497.36 points. While the average PISA reading score of countries with high income inequality was 408.97, the average PISA reading score of countries with low income inequality was 490.27. While the average PISA score of countries with high income inequality was 402.71, the average PISA score of countries with low income inequality was 494.60. It has been determined that countries with low income inequality have higher academic success than countries with high income inequality.

Table 3 – Comparison of PISA results of the countries in the study group (t test)

Countries	N	\bar{x}	SS	F	t	P
PISA Math Averages of Countries with the Lowest Income Inequality (2006-2022)	12	496.18	15.37			
PISA Math Averages of Countries with the Highest Income Inequality (2006-2022)	12	394.27	31.96	5.10	9.57	.000*
PISA Science Averages of Countries with the Lowest Income Inequality (2006-2022)	12	497.36	15.72			
PISA Science Averages of Countries with the Highest Income Inequality (2006-2022)	12	404.89	29.79	2.94	9.14	.000*
PISA Read Averages of Countries with the Lowest Income Inequality (2006-2022)	12	490.27	15.38			
PISA Read Averages of Countries with the Highest Income Inequality (2006-2022)	12	408.97	29.07	3.17	8.56	.000*

*p<.05

It was determined that there was a significant difference ($p<.05$) between the average PISA mathematics scores of countries with high income inequality (2006, 2009, 2012, 2015, 218, 2022) and the average PISA mathematics scores of countries with low income inequality. It was determined that there was a significant difference ($p<.05$) between the average PISA science scores of countries with high income inequality (2006, 2009, 2012, 2015, 218, 2022) and the average PISA science scores of countries with low income inequality. It was determined that there was a significant difference ($p<.05$) between the average PISA reading scores (2006, 2009, 2012, 2015, 218, 2022) of countries with high income inequality and the average PISA reading scores of countries with low income inequality. In the overall average of PISA, it was determined that the success scores of countries with low income inequality were higher than those of countries with high income inequality. PISA success of countries in terms of income inequality shows a significant difference.

Table 4 – Results of correlation

	PISA Math	PISA Science	PISA Read	PISA General
Income Inequality	-.791**	-.791**	-.720**	-.777**

**P < .001

According to the pearson correlation test results, there is a significant and high level ($r = -.791$) inverse relationship between the average income inequality scores of all countries and the average PISA mathematics scores. There is a significant and high level ($r = -.791$) inverse relationship between the average income inequality scores of the countries and the average PISA science scores. There is a significant and high level ($r = -.720$) inverse relationship between the average income inequality scores of the countries and the average PISA reading scores. In this context, it can be said that PISA success decreases as income inequality increases and PISA success increases as income inequality decreases.

Table 5 – Results of simple linear regression

R	R ²	F	t	Beta
.777	.586	33.55	35.04	-.777**

Independent Variable: Income Equality

Dependent Variable: PISA Results

According to the regression test results income inequality affects academic success at a high rate (Beta = $-.777$). Income inequality explains academic success at a high rate of 77%. The difference in academic achievement among students can be explained to a significant extent by income inequality.

Results And Discussion

In this study, it was sought to answer whether there is a significant difference between the mean scores of income inequality and PISA scores, whether there is a significant relationship between income inequality and PISA success, and whether

income inequality significantly explains PISA success. The PISA mathematics test average of countries with high income inequality is significantly lower than the PISA mathematics test average of countries with low income inequality. The PISA science test average of countries with high income inequality is significantly lower than the PISA science test average of countries with low income inequality. The PISA reading test average of countries with high income inequality is significantly lower than the PISA reading test average of countries with low income inequality. It was determined that there was a significant difference ($p < .05$) between the PISA math, science and reading (2006-2022) mean scores of countries with high income inequality and the PISA mean scores of countries with low income inequality. Countries with low income inequality have higher PISA scores than countries with high income inequality. In different studies in the literature, it has been observed that students in countries with high income inequality have lower academic success (Gupta, 2007) (Belot, 2009) (Acham, 2012). It was determined that the academic success of children from families with lower income levels was lower (Brooks-Gunn, 1997). It was determined that in schools where low-income families were concentrated, children from high-income families were generally more successful (Horgan, 2009). While the rate of high school completion was lower among children from poor families, the rate of school completion was higher among children who never experienced poverty (Ratcliffe, 2015).

It was determined that there was a significant and high level ($r = -.791$) inverse relationship between income inequality mean scores and PISA Math mean scores in all countries with high and low income inequality. It was determined that there was a significant and high level ($r = -.791$) inverse relationship between income inequality mean scores and PISA Science mean scores in all countries with high and low income inequality. It was determined that there was a significant and high level ($r = -.720$) inverse relationship between income inequality mean scores and PISA Read mean scores in all countries with high and low income inequality. As income inequality increases, academic success decreases in the opposite direction. There are different studies in the literature supporting these findings: It has been determined that there is a linear process between poverty and academic failure

(Açıkgöz, 2012). There is a reverse process between social inequality and educational success (Kızılgöl, 2012). There is an inverse relationship between school attendance, academic success and poverty (Van der Berg, 2008). There is a reverse process relationship between educational success and inequality (Boston, 2024). Income inequality affects academic success at a high rate (Beta = -.777). Income inequality explains academic success at a high rate of 77%. It is seen that differences in income inequality are decisive in students' academic success.

In countries with high income inequality, sustainable education policies should be developed to combat inequality for low-income students. In this context, a budget can be allocated to each school. Schools with a majority of lower income groups can have a higher budget. Food and transportation services for students can be provided by local governments. Exam preparation, personal development books and digital learning materials can be provided free of charge by the school to low-income students. Study programs in schools outside compulsory education can be provided free of charge to low-income students. In addition to guidance counselors, mentors can be assigned to monitor the academic development of students in at-risk schools. With a protocol between local governments and ministries of education, disadvantaged schools can be prioritized in social responsibility projects.

REFERENCES

Acham, H., Kikafunda, J.K., Malde, M.K., Oldewage-Theron, W.H., & Egal, A.A. (2012). Breakfast, midday meals and academic success in rural primary schools in Uganda: Implications for education and school health policy. *Food & Nutrition Research* 56(1). <https://www.tandfonline.com/doi/full/10.3402/fnr.v56i0.11217#abstract>

Açıkgöz, R., & Yusufoglu, ÖŞ. (2012). The phenomenon of poverty and social repercussions in Turkey. *Journal of the Human and Social Science Researches*, 1(1), 76-117.
https://scholar.google.com/scholar?hl=tr&as_sdt=0%2C5&q=%28A%C3%A7%C4%B1kg%C3%B6z+%26+Yusufoglu%C4%9Flu%2C+2012%29.+&btnG=

Aypay, A. (2022). *Research design*. Ankara: Nobel Publication.

- Belot, M., & James, J. (2009). Healthy school meals and educational outcomes. *Journal of Health Economics* 30(3).
<https://www.sciencedirect.com/science/article/abs/pii/S0167629611000270>
- Boston, J. (2014). Child poverty in New Zealand: Why it matters and how it can be reduced. *Educational Philosophy and Theory* 46(9).
<https://www.tandfonline.com/doi/abs/10.1080/00131857.2014.931002>
- Brooks-Gunn, J., & Duncan, G. (1997). The Effects of poverty on children. *Children and Poverty* 7(2), 55-71. <https://www.jstor.org/stable/1602387>
- Chiu, M.M. (2010). Effects of inequality, family and school on mathematics achievement: Country and student differences. *Social Forces*, 88(4), 1645–1676.
<https://doi.org/10.1353/sof.2010.0019>
- Condrón, D.J. (2011). Egalitarianism and educational excellence: Compatible goals for affluent societies? *Educational Researcher*, 40(2), 47–55.
<https://doi.org/10.3102/0013189X11401021>
- Feinstein, L., Sabates, R., Anderson, T., Sorhaindo, A., & Hammond, C. (2006). What are the effects of education on health?
<https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=32e9079959269c5af50f7ad11a74712968cb01cb>
- GINI (2024). GINI index.
<https://data.worldbank.org/indicator/SI.POV.GINI?year=2023>
- Green, A. (2009) Education, inequality and the erosion of social cohesion. *Forum* 51(1), 5–8. <https://eric.ed.gov/?id=EJ840434>
- Grossman, M. (2005) Education and non-market outcomes. *Handbook of the Economics of Education* 1, 577-633.
<https://www.sciencedirect.com/science/article/abs/pii/S1574069206010105>
- Gupta, R.P.-S., Wit, M.L., & McKeown, D. (2007). The Impact of poverty on the current and future health status of children. *Paediatr Child Health* 12(8), 667-673.
<https://academic.oup.com/pch/article/12/8/667/2647971>
- Haveman, R.H. & Wolfe, B.L. (1984) Schooling and economic well-being: the role of non-market effects. *The Journal of Human Resources*, 19(3), 377–407.
<https://www.jstor.org/stable/145879>
- Hill, T.D. & Jorgenson, A. (2018). Bring out Your Dead: A Study of income inequality and life expectancy in the united states, 2000–2010. *Health & Place*, 49, 1-6.
<https://www.sciencedirect.com/science/article/abs/pii/S1353829217306573>

Hirsch, D. (2004) Strategies against poverty: A shared road map. New York: Joseph Rowntree Foundation. <https://www.donaldhirsch.com/strategies.pdf>

Horgan, G. (2009). That Child is Smart Because He's Rich: The Impact of poverty on young children's experiences of school. *International Journal of Inclusive Education* 13(4), 359-376.
<https://www.tandfonline.com/doi/abs/10.1080/13603110802707779>

Jutz, R. (2015). The role of income inequality and social policies on income-related health inequalities in Europe. *International Journal for Equity in Health*,14(1).
https://idp.springer.com/authorize?response_type=cookie&client_id=springerlink&redirect_uri=https%3A%2F%2Flink.springer.com%2Farticle%2F10.1186%2Fs12939-015-0247-y

Kızılgöl, Ö.A. (2012). The impact of gender inequality in education on poverty in Turkey. *Journal of Management and Economics*, 19(1), 179-191.
<https://dergipark.org.tr/en/pub/yonveek/issue/13696/165766>

Marmot, M. (2004). Status syndrome. *Significance*, 1(4), 150-154.
<https://academic.oup.com/jrssig/article/1/4/150/7028894>

Ministry, N.E. (2013). PISA 2012 preliminary national report. Ankara: General Directorate of Innovation and Education Technologies.

Ministry, N.E. (2015). What is PISA? http://pisa.meb.gov.tr/?page_id=18&lang=tr

OECD (2024). PISA results.
<https://www.oecd.org/en/about/programmes/pisa.html>

Olson, M.E., Diekema, D., Elliott, B.A., & Renier, C.M. (2010). Impact of income and income inequality on infant health outcomes in the United States. *Pediatrics*, 126(6), 1165-1173. <https://doi.org/10.1542/peds.2009-3378>

Ratcliffe, C. (2015). Child poverty and adult success.
<https://www.urban.org/sites/default/files/publication/65766/2000369-Child-Poverty-and-Adult-Success.pdf>

Redmond, G., & Kattuman, P. (2001) Employment polarisation and inequality in the UK and Hungary. *Cambridge Journal of Economics*, 25(4), 467-480.
<https://academic.oup.com/cje/article-abstract/25/4/467/1713085>

Thorson, G.R., & Gearhart, S.M. (2018). The adverse effects of economic inequality on educational outcomes: An examination of PISA scores, 2000-2015. *World Affairs*, 181(3), 286-306. <https://doi.org/10.1177/0043820018799425>

Van der Berg, S. (2008). Poverty and education. Education policy series.

<https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=a003fb3a8192904f42a7bef31328eac3acca62ac>

Wilkinson, R.G., & Pickett, K. (2010) The Spirit level: Why equality is better for everyone. *Journal of Social Policy*, 42(4), 840-842.
doi:10.1017/S0047279413000366

Yaşar, R. (2016). The relationship between poverty, academic success and cultural capital. *Kilis 7 Aralık University Social Sciences Journal*, 6(2), 202-237.
<https://dergipark.org.tr/en/pub/kilissbd/issue/24637/260672>