Proceedings of the International Conference on Global Politics and Socio-Humanities
DOI: 10.54254/2753-7048/44/20230142

Educational Inequality in China (Mainland) from 2017 to 2021: Reasons and Solutions

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Abstract: The aim of this article is to investigate the situation of educational inequality in China (Mainland) from 2017 to 2021. The data of this article is published by China's Ministry of Education. The author creates a unique method to calculate the special Gini Coefficients for those 31 provinces in China (Mainland). By comparing the results, it can be seen that the special Gini Coefficients of the Number of Higher Education Institutions (HEIs), the Number of Educational Personnel in HEIs, and the Number of Compulsory Education (middle school and elementary schools) Institutions are on a moderately increasing trend while only the Special Gini Coefficient of the Condition of Fixed Assets in HEIs shows a slightly decreasing trend. Hence, the author concludes that educational inequality in China (Mainland) is worsening, especially after the pandemic. The author also provides two suggestions for the government to improve this situation.

Keywords: Education, Inequality, Social Justice, Gini Coefficient

1. Introduction

With the development of society, people's pursuit and perception of equality have become clearer. For many countries in the world, equality is an excellent objective that they want to achieve. Constantly, scholars have discovered and pointed out that the ideal equality of human beings may only exist in the utopia of our imagination because inequality still exists in many aspects of our society. Getting rid of the problem of inequality has been one of the most essential concerns of the community because it has brought many obstacles to the stability of human society.

The famous American philosopher John Dewey said, "Education is not preparation for life; education is life itself." Education is a part of any country that cannot be ignored because it represents their future. Inequality in education can increase inequality in other fields of society. As the title of the article, Heymann, Sprague, Raub, and Moseneke suggests, "The Right to Education: A Foundation for Equal Opportunities.

In China, equality is one of the core socialist values. Pursuing equality in the world's most populous country is undoubtedly a significant challenge. In terms of many policies that China has implemented, such as the nine-year compulsory education, it has made many efforts to pursue equality in education. The motivation for this article stems from the gap in the literature in recent years in the area of educational inequality. The outbreak of Covid-19 in 2019 was a huge blow to China's economy and society. According to data published by China's Ministry of Education, the social instability caused

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by the pandemic has also affected the increase in educational inequality between provinces in mainland China.

This article will use a special Gini coefficient calculation to show China's progress against educational inequality from 2017 to 2021. Based on the data published by China's Ministry of Education, the special Gini Coefficients of the Number of Higher Education Institutions, the Number of Educational Personnel in HEIs, and the Number of Compulsory Education (middle school and elementary schools) Institutions are on a moderately increasing trend while only the Special Gini Coefficient of the Condition of Fixed Assets in HEIs shows a slightly decreasing trend. By comparing these five years of data, suggestions on how China can address educational inequality in the future can be made.

2. Literature Review

Social Justice is a crucial concept in explaining inequality. One of my lectures about the Economics of Inequality concludes the definition and evolution of Social Justice:

Social Justice is a concept that focuses on the equality between individuals and their access to wealth and opportunities. During the industrial revolution, because of the extreme inequality caused by the hierarchy structure in European countries, people attempted to promote a more equal society and reduce the exploitation of certain marginalized groups. Hence, Social Justice was more prone to solve the problem of the distribution of wealth at that time. Nowadays, Social Justice has shifted towards a greater emphasis on human rights and improving the lives of vulnerable and marginalized groups who have faced social discrimination. Social Justice often leads to efforts to redistribute wealth to some disadvantaged groups by providing income, work, and education support and opportunities. Equality means each individual or group of people is given the same resources or opportunities. [Lecture notes on Economics of Inequality]

Educational Inequality has always been one of the main concerns in society, and many related articles have been published to study this global issue. In The Right to Education: A Foundation for Equal Opportunities, the authors use this article to emphasize the situation of education equality [1]. Inequality in society is always a troublesome issue in the development of a country, and education inequality is one of the most significant problems. This article contains many statistics, such as school enrollment rates and constitutional guarantees of civil rights [1]. The article also includes several maps that are used to show and compare the educational incentives of the constitutions of different countries worldwide [1]. The text points out many reasons causing the occurrence of educational inequalities and provides much advice for solving this problem [1]. Also, in the article “Educational Inequality, Educational Expansion, and Intergenerational Income Persistence in the United States,” the authors indicate the relationship between family income and children’s educational attainment [2]. The article contains many graphs on descriptive statistics to show the association between income and educational attainment [2]. The slope coefficient from a regression of adult income on parental income is also applied in the paper [2]. The research indicates that children from higher-income families are more likely to become high-income adults, and children from lower-income families are more likely to become low-income adults [2]. This report shows the direct connection between education and income inequality [2]. It also conveys an important message that the government should pay more attention to who graduated from college instead of focusing on how many people graduated [2].

China, as an influential country in the world, also faces Education inequality and attempts to solve it. For instance, in China in the Sustainable Development Agenda: Contributions to health and education, Gåsemyr demonstrates that China is increasing its investments in health and education, which contributes to the UN 2030 Agenda and related SDGs, and it is also working to modernize its entire healthcare system, improve mandatory and additional education, and foster elite academic

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institutions [3]. Moreover, another article, which Zhang wrote, aims at showing the reason, situation, and solution for educational inequality in China [4]. The text classifies education inequality into several categories, like income, area, and school [4]. In the conclusion part, the author indicates the improvement in education in China and the achievements of those policies in aiming at changing this situation [4].

Although much research has been done on educational inequality, much of it is limited to data from a long time ago. As societies have evolved and become more aware of educational inequality, many countries have adopted policies to try to alleviate and address the problem. The innovation of this paper is to study and calculate the latest data in recent years. The new data and analysis will allow the reader to see how China has progressed or regressed on the issue of educational inequality and to analyze how China might respond to this issue in the future.

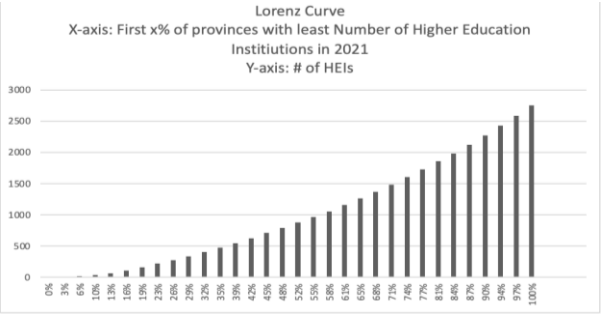
3. Methodology and Data

The Lorenz curve is a graph showing the proportion of overall income or wealth assumed by the bottom x% of the people, and it is often used to represent income distribution, where it shows for the bottom x% of households what percentage (y%) of the total income they have [5]. The Lorenz curve can also be used to show the distribution of assets: in this use, many economists consider it to be a measure of social inequality [5]. The Gini coefficient is based on the cumulative share of the population compared to the cumulative share of the income they receive[Lecture notes on Economics of Inequality].

In this paper, the author made some simplifications in the calculation. For instance, the author considers the Number of Higher Education Institutions, the Number of Educational Personnel in HEIs, the Condition of Fixed Assets in HEIs, and the Number of Compulsory Education (middle school and elementary school) Institutions owned by each province (mainland China) as their wealth. These special Gini coefficients are calculated separately for each category to assess the equality of educational resources among provinces.

Take the Number of Higher Education Institutions as an example. In order to calculate the Gini Coefficient for it, the author first needs to construct the Lorenz curve by doing the following steps:

1. Consider those 31 provinces as 31 people, and the number of Higher Education Institutions they have are their wealth.
2. Sort the provinces according to the number of Higher Education Institutions they have from smallest to largest.
3. Find the cumulative number of Higher Education Institutions for each province from smallest to largest. The poorest province is Tibet which has a cumulative number of 7 Higher Education Institutions, and the richest province is Jiangsu which has a cumulative number of 2756 Higher Education Institutions. 2756 is also the sum of Higher Education Institutions in China (Mainland). In this way, the Lorenz curve can be obtained.



Data Source: Ministry of Education of the People's Republic of China

Figure 1: Lorenz Curve of Number of HEIs in each province in 2021

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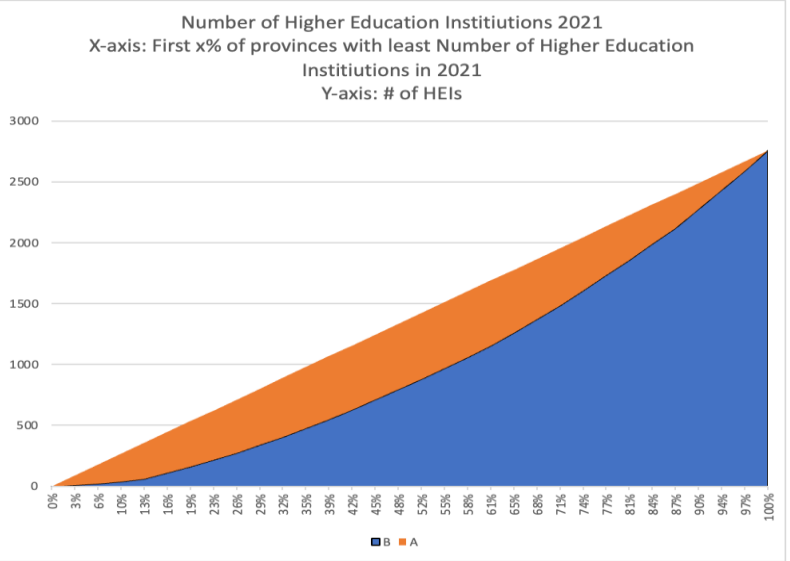
Figure 1 shows the Lorenz Curve that was constructed for calculating our special Gini Coefficients based on n Number of HEIs in each province in 2021. The x-axis of Figure 1 represents the first x% of provinces with the least Number of HEIs in 2021, and the y-axis represents the number of HEIs.

4. Assign index numbers from 1-31 for those 31 provinces from smallest to largest.
5. Line of Equality = total number of Higher Education Institutions / 31 Provinces * Assigned Index Number (1 for Tibet and 31 for Jiangsu). This step aims at finding the line of equality, which is the hypotenuse for the isosceles right triangle.
6. Calculate the difference between the value found in step 5 and step 3 so that the area between the Lorenz curve and the line of equality can be obtained.



Data Source: Ministry of Education of the People's Republic of China

Figure 2: Lorenz Curve and Gini Coefficient of Number of HEIs in 2021

7. Suppose the area of the blue part in Figure 2 is B, and the area of the orange part in Graph 2 is A.
8. Because the figure shaped by the Lorenz curve is irregular, it is necessary to consider the area for each province as a trapezoid and then find the area for each one of them.
   Area of Trapezoid = (long base + short base)*height / 2
   Take Tibet as an example:
   B (Tibet) = (cumulative number of HEI in Tibet+cumulative number of HEI in Qinghai)*(total number of HEI/number of provinces)/2
   = (7 + 19) * (2756 / 31)/ 2 = 311.2
9. B = sum of the area of 31 trapezoids for each province = 2748621.03
10. Area of isosceles right triangle = 2756*2756/2 = 3797768
11. A = Area of isosceles right triangle - B = 3797768 - 2748621.03 = 1049146.97
12. Gini Coefficient = A / Area of isosceles right triangle
    = 1049146.97 / 3797768 = 0.27625357

The use of the Gini coefficient allows the reader to visualize the results because it ends up as a decimal number between 0 and 1, so the reader can understand the equality of the data straightforwardly. The application of the Gini coefficient also contains some potential drawbacks. For instance, the Gini coefficient cannot show which province has the best educational resources or

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has the poorest educational resources because it mainly indicates the overall inequality distribution [6].

The main variables studied in this paper include the Number of Higher Education Institutions, the Number of Educational Personnel in HEIs, the Condition of Fixed Assets in HEIs, and the Number of Compulsory Education (middle school and elementary school) Institutions. The data in this paper are obtained from the education statistics of the Ministry of Education of the People's Republic of China. They are highly reliable because they are officially released. These variables represent the physical and human capital of each province in education, the local government's investment in education resources, and these factors significantly impact the quality of education in the region. The data are from 2017 to 2021, the most recent data available. In 2019, a global outbreak of Covid-19 hit the economies of many countries hard. By comparing education resource data before and after the epidemic, the impact of this epidemic on education inequality can be explored.

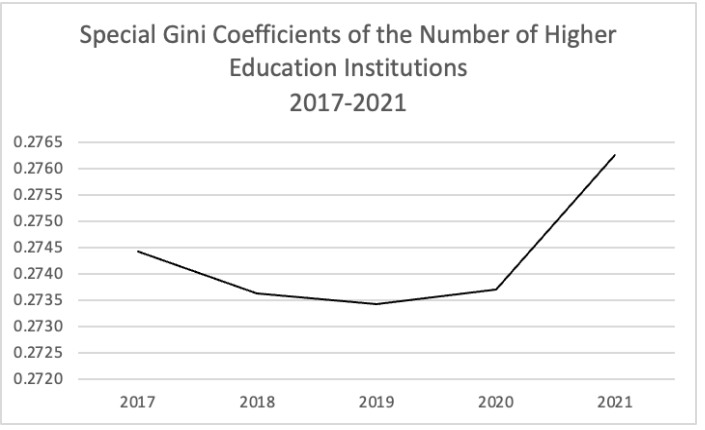
4. Results and Discussion

Table 1: Special Gini Coefficients of the Number of HEIs from 2017 to 2021

Year	Special Gini Coefficients of Number of HEIs
2017	0.2744
2018	0.2736
2019	0.2734
2020	0.2737
2021	0.2763

Data Source: Ministry of Education of the People's Republic of China

Table 1 shows the list of Special Gini Coefficients calculated based on the data published by the Ministry of Education of the People's Republic of China about the Number of HEIs from 2017 to 2021.



Data Source: Ministry of Education of the People's Republic of China

Figure 3: Special Gini Coefficients of the Number of Higher Education Institutions from 2017 to 2021

Figure 3 shows the trend of special Gini Coefficients constructed based on the number of Higher Education Institutions in China (Mainland) from 2017 to 2021. It shows that the number of HEIs inequality relationships in 31 provinces of China from 2019 onwards are on the rise. One of the reasons for this trend may be due to Covid-19. During the outbreak of Covid-19, many schools

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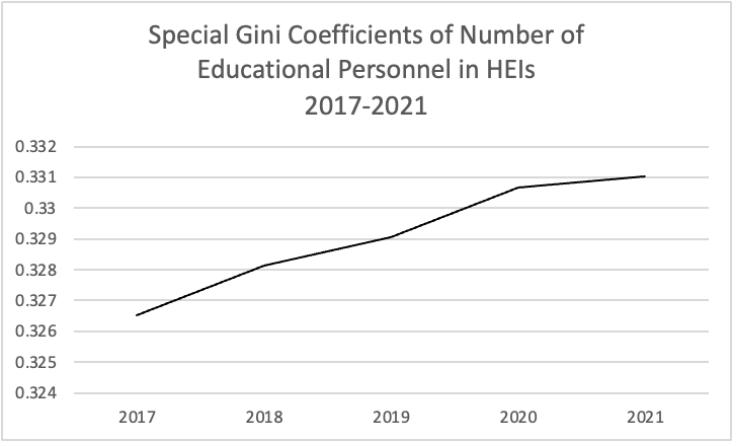
adopted the online teaching mode. This change may have led to the closure of some higher education institutions that could not make ends meet. Another reason could be China's recent Agenda, which, according to the message Gåsemyr conveys in China in the Sustainable Development Agenda: Contributions to health and education, is an effort to build elite academic institutions [3]. This may also lead to a skewing of educational resources, as such an approach may lead the government to optimize places where the quality of education and resources are already good so that they can quickly reach and develop elite education. Although our special Gini coefficient produced for the Number of Higher Education Institutions has been trending upward since 2019, the overall upward trend is insignificant. This may be because establishing colleges and universities can be costly in terms of human and material resources, so it takes time to reduce inequality gradually.

Table 2: Special Gini Coefficients of the Number of Educational Personnel in HEIs from 2017 to 2021

Year	Special Gini Coefficients of Number of Educational Personnel in HEIs
2017	0.3265
2018	0.3281
2019	0.3291
2020	0.3307
2021	0.3310

Data Source: Ministry of Education of the People's Republic of China

Table 2 shows the list of Special Gini Coefficients calculated based on the data published by Ministry of Education of the People's Republic of China about the Number of Educational Personnel in HEIs from 2017 to 2021.



Data Source: Ministry of Education of the People's Republic of China

Figure 4: Special Gini Coefficients of the Number of Educational Personnel in HEIs from 2017 to 2021

Figure 4 shows the trend of the special Gini Coefficients created based on the number of Educational Personnel in Higher Education Institutions in China (Mainland) from 2017 to 2021. According to the figure, it shows that the trend of inequality in 31 provinces has always increased during these five years. Educational Personnel is a very important part of the whole education system because it has a decisive effect on the quality and level of education. One of the reasons that may cause this trend is the Chinese Talent Introduction Policy. This policy means the local government

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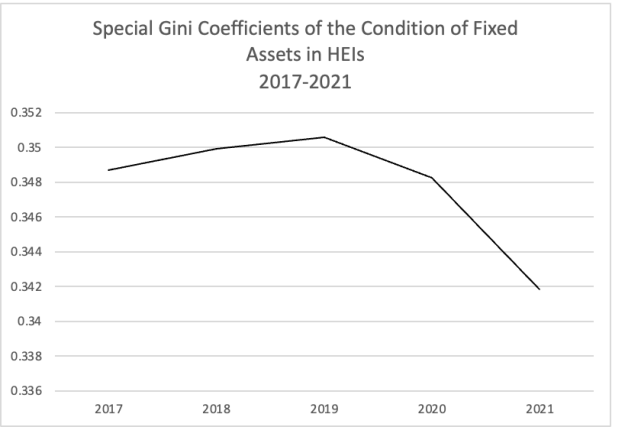
uses benefits and allowances to attract those people who have outstanding educational backgrounds to settle down and work here. Hence, many educational personnel may decide to move to those provinces, where most of them are advanced and will offer them more opportunities and benefits. This policy might lead to the problem of brain drain for those provinces where they don't have many resources.

Table 3: Special Gini Coefficients of the Condition of Fixed Assets in HEIs from 2017 to 2021

Year	Special Gini Coefficients of the Condition of Fixed Assets in HEIs
2017	0.3487
2018	0.3499
2019	0.3506
2020	0.3483
2021	0.3418

Data Source: Ministry of Education of the People's Republic of China

Table 3 shows the list of Special Gini Coefficients calculated based on the data published by the Ministry of Education of the People's Republic of China about the Condition of Fixed Assets in HEIs from 2017 to 2021.



Data Source: Ministry of Education of the People's Republic of China

Figure 5: Special Gini Coefficients of the Condition of Fixed Assets in HEIs from 2017 to 2021

Figure 5 shows the trend of the special Gini Coefficient calculated based on the Condition of Fixed Assets in Higher Education Institutions in China (Mainland) from 2017 to 2021. According to the figure, it shows that from 2017 to 2018, the special Gini Coefficient increased year by year. However, from 2019 to 2021, the special Gini Coefficient start to decrease. One of the reasons that may cause this change is the Chinese Sustainable Development Agenda. Based on the article published by the Gåsemyr in 2020 about *China in the Sustainable Development Agenda: Contributions to health and education* clearly states that China is increasing its investments in health and education, which contributes to the UN 2030 Agenda and related SDGs [3]. This information could explain the decreasing inequality of fixed asset conditions between provinces. Some fixed assets, such as books and digital terminals, are accessible once the institute has capital, so the inequality in the Condition of Fixed Assets in HEIs can be improved in a short time.

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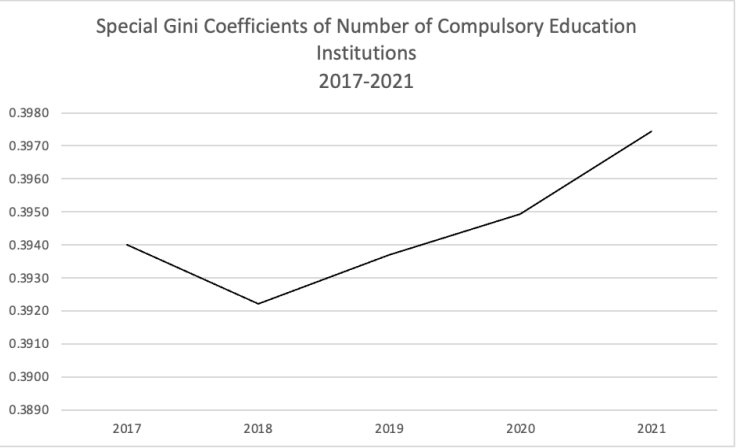
Table 4: Special Gini Coefficients of the Number of Compulsory Education Institutions from 2017 to 2021

Year	Special Gini Coefficients of the Number of Compulsory Education Institutions
2017	0.3940
2018	0.3922
2019	0.3937
2020	0.3949
2021	0.3974

Data Source: Ministry of Education of the People's Republic of China

Table 4 shows the list of Special Gini Coefficients calculated based on the data published by the Ministry of Education of the People's Republic of China about the Number of Compulsory Education Institutions from 2017 to 2021.



Data Source: Ministry of Education of the People's Republic of China

Figure 6: Special Gini Coefficients of the Number of Compulsory Education Institutions from 2017 to 2021

Figure 6 shows the trend of the special Gini Coefficient constructed based on the Number of Compulsory Education Institutions in China (Mainland) from 2017 to 2021. According to the figure, it shows that inequality started to get more severe in 2018-2021. Although Compulsory education is on the rise, the overall change is not significant. From 2018 to 2021, the special Gini coefficient calculated only increased by 0.05. One of the reasons for this phenomenon may be because China has been implementing a nine-year compulsory education policy for many years, so it has reached a stable state.

Based on the data published by China's Ministry of Education, the special Gini Coefficients of the Number of Higher Education Institutions, the Number of Educational Personnel in HEIs, and the Number of Compulsory Education (middle school and elementary schools) Institutions are on a moderately increasing trend while only the Special Gini Coefficient of the Condition of Fixed Assets in HEIs shows a slightly decreasing trend.

This created a special Gini coefficient with a few shortcomings to improve in the future. The first weakness is that it does not consider the quality of schools. For example, Peking University has a value of 1 here, while those regular universities also have a value of 1 in this calculation. From this point of view, the calculation needs to be improved because the link between the quality of the school

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and the equality of education is very significant. In the future, this drawback can be improved by ranking all higher education institutions with a score. Another weakness is that the base situation varies from province to province. Differences in area and population base between provinces also have an impact.

5. Conclusion

This article is dedicated to studying China's progress on educational inequality in recent years. Based on the data published by China's Ministry of Education, the special Gini Coefficients of the Number of Higher Education Institutions, the Number of Educational Personnel in HEIs, and the Number of Compulsory Education (middle school and elementary schools) Institutions are on a moderately increasing trend. At the same time, only the Special Gini Coefficient of the Condition of Fixed Assets in HEIs shows a slightly decreasing trend. From the results, it can be seen that China still needs more effort to realize equality in education. By observing the special Gini coefficients that are calculated, the following suggestions can be made:

1. In response to the inequality of educational personnel, the central government could support those local governments that need more educational personnel to attract more people to return or settle in places in need to build and improve the quality of local education by formulating a welfare policy.
2. In the short term, the government can alleviate the inequality of educational resources by providing some fixed assets. In the long run, the Ministry of Education of the People's Republic of China can set up more campuses of higher education institutions in less-resourced areas to better overcome the obstacles brought by inequality in education in the future.

Future research on educational inequality in China can be made more rigorous by using the special Gini algorithm that is created, which takes into account, for example, the quality of schools and the conditions of the provinces to produce more accurate results and conclusions. By further improving the calculation, the developments and the trend of educational inequality will become more accurate so that more effective solutions can also be offered.

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