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Data Visualization of Higher Education Participation Rates in Indonesia Provinces

Joko Saputro[1*], Kanika Saini[2], Hany Maria Valentine[3]

[1*,3]*Study Program of System Information, Bung Karno University, Jakarta, Indonesia*
[2]*Department of Bioscience, Faculty of Science, Pandit Deendayal Upadhyaya Shekhawati University, Rajasthan, India*
[1*]*jokosaputro@ubk.ac.id* , [2]*kaniksaini184@gmail.com*, [3]*hmvalentine@ubk.ac.id*
**Corresponding Author*

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ABSTRACT

The objective of this study is to analyze the disparity in higher education enrollment in Indonesia using data visualization produced by the Exploratory Data Analysis (EDA) technique. This graphic specifically examines the Gross Participation Rate of higher education among provinces, expenditure quintiles, and genders for the period of 2019 to 2023. The data was gathered from Statistics Indonesia and presented using Google Data Studio to offer a clearer and more comprehensible representation of the disparity. The findings indicate notable variations in Gross Participation Rate across provinces, with DI Yogyakarta continuously exhibiting the highest Gross Participation Rate and Bangka Belitung Islands displaying the lowest Gross Participation Rate over the duration of the study. Furthermore, Gross Participation Rate exhibits greater values within the quintile 5, which represents the group with the highest expenditure. Additionally, Gross Enrollment Rate is also higher in females when compared to males. The resulting visualization can serve as a potent instrument for policy makers to comprehend and tackle disparities in access to higher education in Indonesia.

1. Introduction

In numerous nations, including Indonesia, higher education is a critical factor in the advancement of economic and social development. In addition to its impact on individuals, it also makes a substantial contribution to national development by enhancing the skills of the workforce, fostering innovation, and fortifying the capacity of public institutions. A country's ability to compete on a global scale is frequently enhanced by its high participation in higher education (Goczek et al., 2021). In Indonesia, higher education is considered as one of the main keys to improving national competitiveness. However, with a population of more than 270 million people spread across various provinces with very diverse geographical, social, and economic characteristics, the challenges of providing equitable access to higher education are increasingly complex (Abad-Segura & González-Zamar, 2021; Sakhiyya & Rahmawati, 2024). Participation in higher education is often used as an important indicator of social and economic progress, where high participation rates reflect better welfare, higher social equality, and faster economic growth (Long & Ji, 2019).

However, the higher education participation rate in Indonesia still faces various challenges, especially related to inequality of access between provinces. These inequalities are caused by various factors, including differences in the availability of higher education institutions, the quality of education, supporting infrastructure, as well as the economic and social conditions of local

communities (Brewis, 2019). In addition, cultural factors and perceptions of the importance of education also affect participation in some areas. These challenges are further exacerbated by the limited data available and the lack of efforts to present the data in a form that is easily understood by policy makers. As a country with a large and heterogeneous population, Indonesia shows significant variations in higher education participation rates among its provinces (Fadhil & Sabic-El-Rayess, 2021). This inequality poses a serious problem, namely the existence of unequal access to higher education, which has the potential to widen social and economic disparities between regions. Therefore, data visualization analysis of higher education participation rates across provinces in Indonesia is essential to understand the pattern of inequality and to formulate more appropriate policies (Atmaja et al., 2022; Riani et al., 2024).

The urgency of this research lies in the need to provide a visual analysis tool that can be used by policy makers to map and address inequality in higher education participation in Indonesia. Proper data visualization will allow for more intuitive interpretation of current conditions and patterns (Radhitya et al., 2024) development of higher education participation in different provinces, thus providing a strong basis for more effective and targeted decision-making (Dewi et al., 2024; Sudipa et al., 2023).

This study aims to develop a comprehensive and interactive data visualization of higher education participation rates in Indonesian provinces, using the Explanatory Data Analysis (EDA) method. Through this approach, it is hoped that this research can provide deeper insights into the factors that influence higher education participation and how these patterns vary across Indonesia. The main contribution of this research is the provision of data visualizations that can be accessed and used by policy makers, academics, and the general public to understand and address inequalities in higher education participation in Indonesia. This research is also expected to encourage further studies that use data visualization approaches in education policy analysis in Indonesia.

2. Literature Review

In order to obtain an accurate representation of higher education enrolment rates in Indonesian provinces, it is essential to take into account a range of factors that impact the accessibility and levels of involvement in education. Various factors, including per capita income, levels of secondary and higher education, the number of environmental schools, and government regulations, have a substantial impact on education outcomes in different regions (Ernanto, 2024; Jayanti et al., 2020; Wijaya, 2019). Gaining an understanding of these characteristics might provide valuable insights into the discrepancies and difficulties experienced by different provinces in Indonesia.

Analyzing the correlation between education levels and economic growth is essential. Studies indicate that provinces with higher education levels tend to have more concentrated education resources, which can impact economic development (Liu, 2022). Additionally, the expansion of higher education institutions and the quality of education provided are key determinants of human capital development, influencing economic growth (Ou & Zhao, 2022).

When exploring the effectiveness of education policies, particularly in higher education institutions, conducting in-depth case studies to evaluate the implementation and impact of these policies is crucial. For instance, the Merdeka Belajar Kampus Merdeka (MBKM) policy in Indonesian higher education institutions serves as a case where detailed analyses can offer valuable insights into policy effectiveness (Anggara, 2023).

Moreover, examining the factors affecting gross enrollment rates in higher education can illuminate the challenges and opportunities within the Indonesian higher education sector. Factors such as socio-demographic characteristics, technological advancements, and the quality of education provided to lecturers can influence enrollment rates and overall educational outcomes (Nurjanah, 2024; Sutrisno et al., 2023).

To enhance the visualization of higher education participation rates, considering the geographical distribution of universities and majors across different provinces is essential. The complexity and fragmentation of the higher education system in Indonesia, with thousands of universities offering a wide range of majors, underscore the necessity to capture this diversity in any data visualization efforts (Lambey et al., 2024).

A comprehensive data visualization of higher education participation rates in Indonesian provinces should encompass various factors such as income levels, education quality, policy effectiveness, and economic growth. By integrating these diverse elements, policymakers and stakeholders can gain a holistic understanding of the educational landscape in Indonesia and make informed decisions to promote equitable access to higher education across all provinces.

3. Research Methods

The research method used in this study is Exploratory Data Analysis (EDA), which is a data analysis approach that aims to understand the structure of data by utilizing data visualization techniques (Wibowo & Kraugusteeliana, 2024). EDA not only allows researchers to discover patterns, anomalies, and relationships in the data, but also helps in structuring the analysis. In the context of this study, EDA is used to explore and analyze higher education participation rates across different provinces in Indonesia.

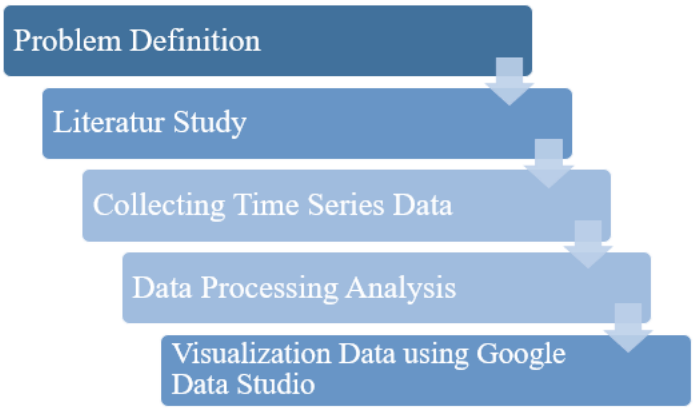

Fig.1. Research Stages

The research phase commenced with the formulation of the problem, which served as the foundation for the entire research process. The primary objective of the research at this stage is to comprehend and identify disparities in higher education participation in Indonesia, as well as to create data visualizations that can facilitate more informed policy decision-making. The researcher conducted a literature review of a variety of relevant literature and previous studies, including theories and findings that could substantiate the data analysis to be conducted, after the problem was defined.

This phase of the research was the continuation of the investigation. Time series data on higher education participation are acquired from an official source, the Central Bureau of Statistics (BPS), in the subsequent step of data collection. This data contains information on the participation rates of higher education in a variety of Indonesian provinces over the course of several years, which will serve as the foundation for additional analysis. The subsequent phase involves the processing and analysis of the data that has been collected. The data that has been acquired is processed at this stage to guarantee its consistency and cleanliness prior to analysis. This procedure entails the removal of incomplete or irrelevant data, as well as the transformation of the data to meet the analysis's requirements.

EDA techniques were employed to analyze the data, which included the extraction of pertinent patterns and the application of descriptive statistics. Google Data Studio was employed to execute the concluding phase of this investigation, which involved data visualization. The selection of Google Data Studio was based on its capacity to generate interactive and comprehensible data visualizations, which facilitate the presentation of researchers' findings. The visualizations that result from this process include graphs, diagrams, and maps that illustrate the variances in higher education

participation among provinces. This information will assist policymakers in comprehending the current disparities and developing more effective strategies to mitigate them.

4. Results and Discussions

Data Analysis

The data used in this visualization is data in the form of college Gross Participation Rate with vulnerable years 2019-2023 obtained from the Indonesian Central Bureau of Statistics website. There are several types of time series data on the Gross Participation Rate of higher education, namely based on 34 provinces in Indonesia, based on gender and based on expenditure quintiles in 2019-2023, namely grouping expenditure into five equal groups after being sorted from the smallest to the largest expenditure. Quintiles consist of the first to fifth quintiles. The higher the quintile group, the higher the expenditure.

Data Visualization

The time series data demographic trend visualization process uses google data studio tools. Data visualization is carried out separately from the vulnerable years 2019-2023, which is useful to be able to know the data demographics of the time series data of the Gross Participation Rate of higher education in each year. Data based on 34 provinces in Indonesia using visualization in the form of table diagrams and data mapping, data based on gender using score card visualization and data based on expenditure quintiles in 2019 using circle visualization.

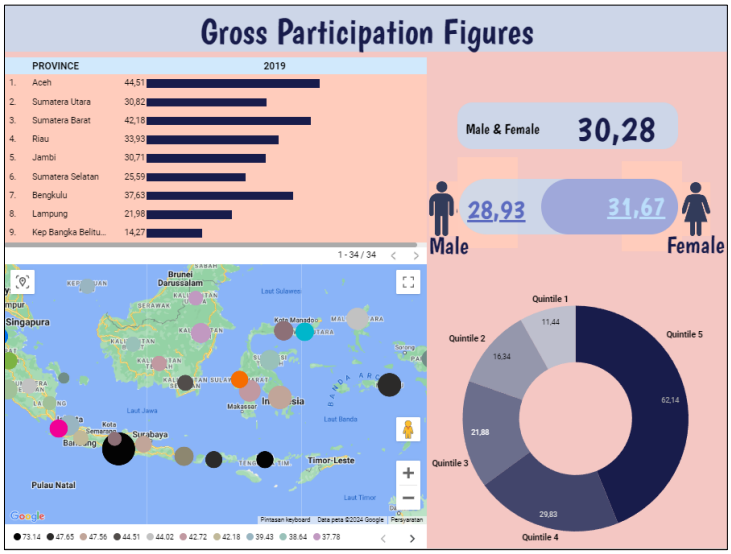

Fig.2. Results of Data Visualization of Gross Enrollment Rate of Higher Education in 2019

The figure above is a visualization of the data on the Gross Enrollment Rate of higher education by province in 2019. The data visualization displayed is a table diagram and a map diagram with rows displaying the percentage of the Gross Participation Rate of universities from 34 provinces in Indonesia. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education by province in 2019 is in DI Yogyakarta province with a percentage of 73.14%. The lowest percentage of Gross Participation Rate in higher education by province in 2019 is in the province of Bangka Belitung Islands with a percentage of 14.27%.

The data visualization displayed is a pie chart. The data used in this visualization is data on the Gross Participation Rate of tertiary institutions based on expenditure quintiles. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2019 is located in the 5th quintile with a percentage of 62.14%. The lowest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2019 is located in the 1st quintile with a percentage of 11.44%.

From the visualization above, it can be seen that the percentage value of the Gross Participation Rate of tertiary institutions based on female gender is higher than that of males with a percentage of 28.93% and 31.67% respectively, with an average overall percentage of 30.28%.

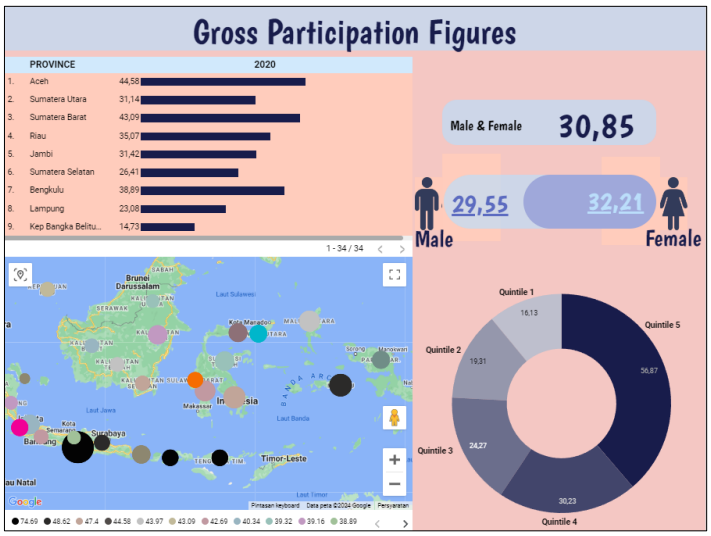

Fig.3. Results of Data Visualization of Gross Enrollment Rate of Higher Education in 2020

The figure above is a visualization of the data on the Gross Participation Rate of higher education by province in 2020. The data visualization displayed is a table diagram and mapping area with rows that display the percentage of the Gross Participation Rate of tertiary institutions from 34 provinces in Indonesia. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education by province in 2020 is in DI Yogyakarta province with a percentage of 74.69%. The lowest percentage of Gross Participation Rate in higher education by province in 2020 is in the province of Bangka Belitung Islands with a percentage of 14.73%.

The data visualization displayed is a pie chart. The data used in this visualization is data on the Gross Participation Rate of tertiary institutions based on expenditure quintiles. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2020 is located in the 5th quintile with a percentage of 56.87%. The lowest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2020 is located in the 1st quintile with a percentage of 16.13%.

Visualization with scorecards of the Gross Enrollment Rate of tertiary institutions based on gender in 2020. From the visualization above, it can be seen that the percentage value of the Gross Participation Rate of tertiary institutions based on female gender is higher than that of males with a percentage of 32.21% and 29.55% respectively, with an average overall percentage of 30.85%.

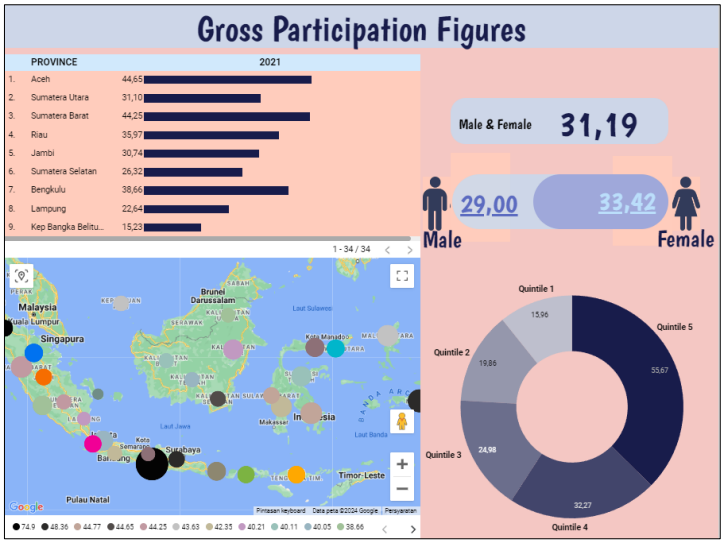

Fig.4. Results of Data Visualization of Gross Enrollment Rate of Higher Education in 2021

The figure above is a visualization of the data on the Gross Participation Rate of higher education by province in 2021. The data visualization displayed is a table diagram with rows displaying the percentage of the Gross Participation Rate of tertiary institutions from 34 provinces in Indonesia. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education by province in 2021 is in DI Yogyakarta province with a percentage of 74.90%. The lowest percentage of Gross Participation Rate in higher education by province in 2021 is in the province of Bangka Belitung Islands with a percentage of 15.23%.

The data visualization displayed is a pie chart. The data used in this visualization is data on the Gross Participation Rate of tertiary institutions based on expenditure quintiles. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2021 is located in the 5th quintile with a percentage of 55.67%. The lowest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2021 is located in the 1st quintile with a percentage of 15.96%.

From the visualization above, it can be seen that the percentage value of the Gross Participation Rate of tertiary institutions based on female gender is higher than that of males with a percentage of 33.42% and 29.00% respectively, with an average overall percentage of 31.19%.

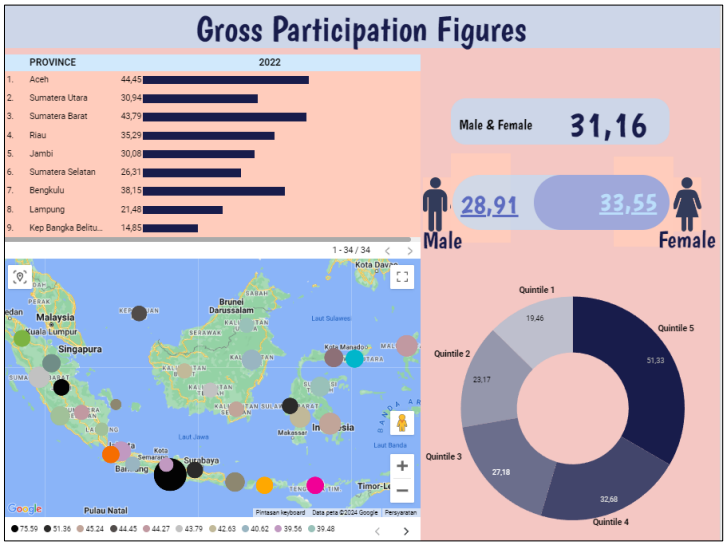

Fig.5. Results of Data Visualization of Gross Enrollment Rate of Higher Education in 2022

The figure above is a visualization of the data on the Gross Participation Rate of higher education by province in 2022. The data visualization displayed is a table diagram and a map diagram with rows displaying the percentage of the Gross Participation Rate of tertiary institutions from 34 provinces in Indonesia. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education by province in 2022 is in DI Yogyakarta province with a percentage of 75.59%. The lowest percentage of Gross Participation Rate in higher education by province in 2022 is in the province of Bangka Belitung Islands with a percentage of 14.85%.

The data visualization displayed is a pie chart. The data used in this visualization is data on the Gross Participation Rate of tertiary institutions based on expenditure quintiles. From the results of the data visualization above, it can be seen that the highest Gross Participation Rate percentage in higher education based on expenditure quintiles in 2022 is located in the 5th quintile with a percentage of 51.33%. The lowest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2022 is located in the 1st quintile with a percentage of 19.46%.

From the visualization above, it can be seen that the percentage value of the Gross Participation Rate of higher education based on female gender is higher than that of male with a percentage of 33.52% and 28.91% respectively, with an average overall percentage of 31.16%.

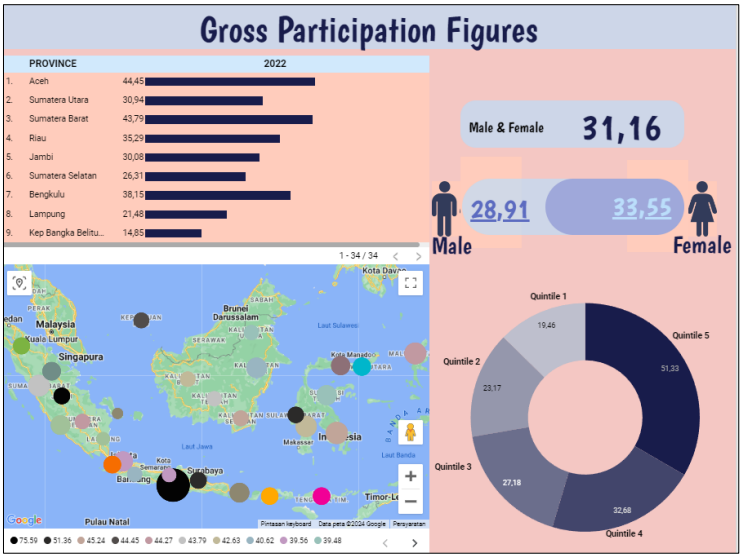

Fig.6. Results of Data Visualization of Gross Enrollment Rate of Higher Education in 2023

The figure above is a visualization of the data on the Gross Participation Rate of higher education by province in 2023. The data visualization displayed is a table diagram with rows displaying the percentage of the Gross Participation Rate of tertiary institutions from 34 provinces in Indonesia. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education by province in 2023 is in DI Yogyakarta province with a percentage of 74.08%. The lowest percentage of Gross Participation Rate in higher education by province in 2023 is in the province of Bangka Belitung Islands with a percentage of 18.19%.

The data visualization displayed is a pie chart. The data used in this visualization is data on the Gross Participation Rate of tertiary institutions based on expenditure quintiles. From the results of the data visualization above, it can be seen that the highest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2023 is located in the 5th quintile with a percentage of 52.66%. The lowest percentage of Gross Participation Rate in higher education based on expenditure quintiles in 2023 is located in the 1st quintile with a percentage of 17.51%.

From the visualization above, it can be seen that the percentage value of the Gross Participation Rate of tertiary institutions based on female gender is higher than that of males with a percentage of 33.87% and 29.12% respectively, with an average overall percentage of 31.45%.

5. Conclusion

The conclusion of the research is based on data visualization using Google Data Studio which can describe the Gross Participation Rate of higher education, the visualization results show that there are significant inequalities in the Gross Participation Rate of higher education in Indonesia based on province, expenditure quintile, and gender. From the visualization results above, it can be seen that the Gross Participation Rate of higher education each year is very dynamic. From the map diagram and row diagram above, the percentage of the Gross Participation Rate for the highest and lowest percentages is always in the same province, namely DI Yogyakarta Province with the highest percentage and Bangka Belitung Islands Province with the lowest percentage in 2019-2023. Visualization of data from the Gross Participation Rate of higher education based on expenditure quintiles, the highest percentage is always in quintile 5, while the lowest percentage is always in quintile 1. Based on the visualization of the data of the Gross Participation Rate of higher education based on gender, the highest percentage of Gross Participation Rate is always in the percentage of Gross Participation Rate with female gender. The contribution of research in the field of education data analysis, especially in the context of inequality in access to higher education in Indonesia. By using data visualization methods, this research successfully presents complex information in a way that is more intuitive and easily understood by policy makers, academics, and the general public. For future research, it is recommended to explore other factors that influence Gross Participation Rate, such as education quality, infrastructure, and social and cultural variables.

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