Trends in Global Education Enrollment

Aanya Vusirikala (Emory ID: 2558223)
Anushka Basu (Emory ID: 2551669)
Saanvi Sood (Emory ID: 2494531)
Brian Tekadtuera (Emory ID: 2577545)

Report Highlights

Oour report analyzes the evolution of primary, secondary, and tertiary school enrollment trends from 1990 to 2023 (this was collected in the dataset) in Afghanistan, India, and Japan, representing different stages of economic development.

Introduction

This project hopes to analyze education levels across three nations with different levels of economic development: Afghanistan (Less Developed Country - LDC), India (More Developed Country - MDC), and Japan (Developed Country- DC). Specifically, we aim to assess school enrollment at different levels in the education system, as sourced from the World Bank. The indicators under investigation include: School enrollment, primary (% gross) (SE.PRM.ENRR); School enrollment, secondary (% gross) (SE.SEC.ENRR); and School enrollment, tertiary (% gross) (SE.TER.ENRR).

By conducting this analysis, we hope to assess the relationship between a country's economic status and the state of its educational enrollment. This can lead to possible discussions surrounding how the level of investment, accessibility, and quality of schools can be impacted by a nation's degree of economic advancement, or on the flip side, how lower enrollment impacts the financial standing of a country.

Data Description

The data was sourced from the World Bank's World Development Indicators via the wbgapi Python package. We selected three key indicators were used to assess enrollment across different educational levels:

- Primary school enrollment, gross (%): {SE.PRM.ENRR}

- Secondary school enrollment, gross (%): {SE.SEC.ENRR}
- Tertiary school enrollment, gross (%): {SE.TER.ENRR}

Data was collected for the years 1971–2020 for Afghanistan, India, and Japan. We wanted to make sure all the countries had the same year range so we removed years before and after (i.e. 1970) if they were not included in all three datasets.

Because missing values were sparesely present (i.e.missing tertiary school enrollment for 2003-2006 in Afghanistan) we decided not to drop NaNs because that would result in removing several years of data.

Merging and cleaning procedures:

- Defined an indicator dictionary mapping indicator names to their World Bank codes

- Merged data from all three indicators for each country into one table

- Transposed table so each row represents a year

- Converted a dataframe into an in-memory SQLite database

- Separated data into three country specific tables (Afghanistan, India, Japan)

- Renamed columns for easier readability

- Converted country tables to csv

Summary Statistics in tabular format

Note that some of these numbers are greater than 100 because of how enrollment ratio is calculated by the world data bank. See definitions here: ("World Development Indicators Metadata: Tertiary Enrollment," n.d.)

Country	Avg Primary Enrollment	Avg Secondary Enrollment	Avg Tertiary Enrollment
India	96.7647	51.1813	13.9066
Japan	102.7267	97.8190	38.8526
Afghanistan	62.8094	26.3104	2.9356

Data Analysis

We began by plotting the primary, secondary, and teritary enrollment levels for each country to get a feel for the data. The code is hidden her for readability but is available in our scripts folder!

Plot India enrollement levels

Unable to display output for mime type(s): text/html

Unable to display output for mime type(s): text/html

Japan enrollement levels

Unable to display output for mime type(s): text/html

Afghanistan enrollement levels

Unable to display output for mime type(s): text/html

Bar Chart Visualization

This bar chart is animated with the help of ChatGPT in order to show how enrollment rates vary by year. This is similar to the previous three graphs but enables us to see all the information in one place!

Unable to display output for mime type(s): text/html

Tertiary School Enrollment Plot

We chose to run further analyses zooming in on tertiary enrollment. The motivation behind this was that tertiary enrollment captures each country's capacity to educate and retain students beyond compulsory schooling, which is a key indicator of development and long-term economic growth. (World Bank 2024)
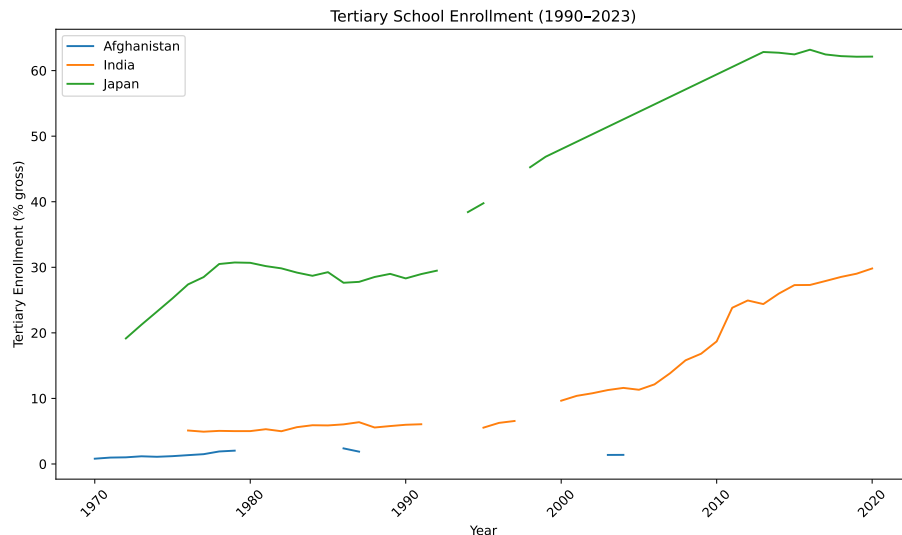
Tertiary School Enrollment (with intraplation to fill in missing values)

We used linear intrapolation to fill in missing values to create a more "smooth" and complete looking plot of tertiary enrollment.
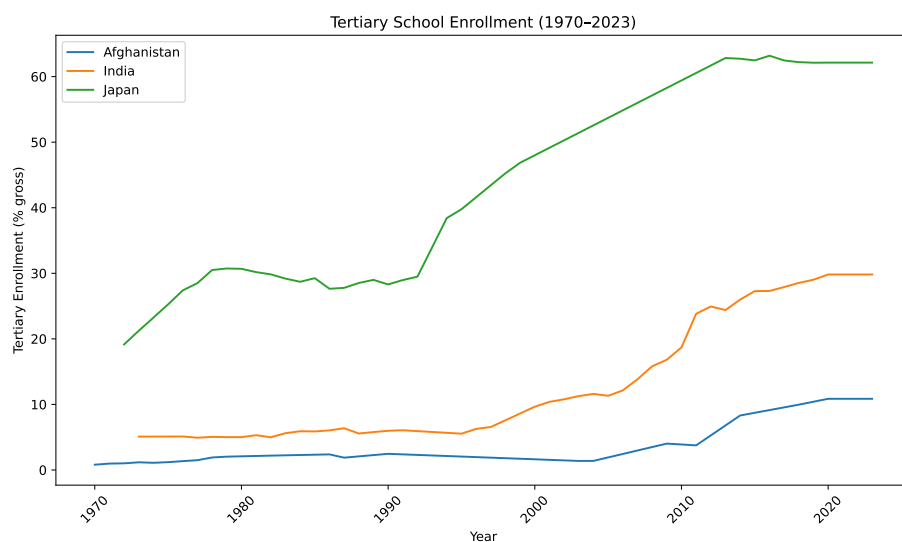
Tables

Tertiary School Enrollment Table

Country	Avg. Tertiary Enrollment (%)
India	13.91
Japan	38.85
Afghanistan	2.94

Tertiary School Enrollment Differences Table

Country Pair	Avg. Tertiary Enrollment (Country A)	Avg. Tertiary Enrollment (Country B)	Difference (B − A)
India vs. Japan	13.91 %	38.85 %	+24.94
India vs. Afghanistan	13.91 %	2.94 %	−10.97
Afghanistan vs. Japan	2.94 %	38.85 %	+35.92

Results and Dicussion

In this section we will dicuss and interpret our results based on our data analyses and visualizations!

The observed enrollment trends across Afghanistan, India, and Japan align with their respective stages of economic development, as outlined in the introduction.

Afghanistan Analyses Discussion

Afghanistan had relatively low primary, secondary, and tertiary enrollment from 1970 to 2000. However, looking at our data visualization, we noticed that primary enrollment skyrocketed in the early 2000s. Upon further research, it seems like this increase in enrollment is likely caused by the fall of the Taliban which led to a subsequent influx of international aid and development efforts. ("Afghanistan Community Schools," n.d.)

This major event also seems to have some spillover effects to secondary enrollment figures, which increased from ~14% in 2003 to ~57% in 2018.

Moving forward to the tertiary enrollment rates, they were quite consistent from 1970-1979, ranging from ~0.8%-2%. Further on, due to limited and sporadic data, it is difficult to make any concrete conclusions, in regards to tertiary enrollment in Afghanistan.

India Analyses Discussion

India's primary enrollment rate has stayed above 80% since 1972. Starting in 2002, is when it exceeded 100%, and has remained so until 2020, excluding a small dip in 2019 to 99.5%. This may be associated with the release of the Sarva Shiksha Abhiyan (SSA) campaign, meaning "Education for All". This was a major education initiative in India launched in 2001-2002 to provide free and compulsory elementary education for all children aged 6-14 by 2010. ("Manual for Planning and Appraisal of School Education Programs," n.d.)

We see that over time, the gap between the secondary and primary enrollment rates has reduced, from ~55% in 1972 to ~24% in 2020. This gap has consistently reduced since the 70s, but especially starting 1999.

Finally, observing the tertiary enrollment, it stayed quite consistent from 1976 to 1999, between ~5-7%. However, starting 2000, we see a gradual increase, reaching ~30% by 2020, with a ~47% gap with secondary enrollment.

Japan Analyses Discussion

Japan has consistently high enrollment rates at all levels. We see that primary enrollment rates are approaching 100%, exemplifying a standard norm of attendance.

This norm also translates to secondary education, which has been above 90% from 1972 until 2020. This deviates from what we saw in India, which had a 24% gap between its primary and secondary enrollment rates in 2020.

However, this is not seen when looking at tertiary enrollment, which was at 62% in 2020. Regardless, it has seen a dramatic ~40% growth since 1972, especially increasing between 1998 and 2020..

Tertiary School Enrollment Analyses Dicussion

In addition to comparing overall enrollment distributions by country, we chose to focus on tertiary gross enrollment ratios, which are an indicator of higher-education access. As defined by the World Bank, *"Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown."* Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level"

From 1970 through 2000, India and Afghanistan exhibited very similar tertiary enrollment levels, with both remaining largely flat over that period. India's rates were consistently just above Afghanistan's, reflecting its somewhat higher development status. In contrast, Japan, which served as our benchmark for a high-income and economically developed country, started at substantially higher tertiary enrollment and showed a steady, almost linear rise from 1970 to 2020. After 2000, India and Afghanistan both began to see modest increases in tertiary participation, though they still lag well behind Japan's sustained growth.

Conclusion

Our project revealed clear links between economic development and school enrollment patterns. Japan, as a high-income country, consistently maintains very high primary and secondary enrollment and shows the strongest, most sustained growth in tertiary participation. However, as we expected less developed nations (i.e. India and Afghanistan) show far lower enrollement rates and less increase in these enrollment rates. This trend is especially evident in terms of teritary enrollment. These disparities underscore the importance of economic resources and policy that priorities access to higher education. Research indicates that enrollment rates and economic development and growth go hand in hand; accelerating economic development means investing in education at every level, particuarly tertiary education. ("Investing in Quality Education for Economic Development, Peace, and Stability," n.d.)

Future Steps

- **Expand the countries used.** It would be interesting to add a few more middle-income countries (e.g., Brazil, South Africa) to see how they compare to the three countries currently in our dataset
- **Forecast future trends.** It would be interesting to extrapolate our data to forecast how enrollment rates will change in the next 5 to 10 years!

Further Reading

- **World Bank Website**
  World bank data.
  https://www.worldbank.org/

- **World Bank API Documentation**
  Instructions on how to query the World Bank's data API and pull indicators programmatically.
  https://datahelpdesk.worldbank.org/knowledgebase/topics/125589-developer-information

- **Primary School Enrollment**
  Where we sourced our data on primary enrollment levels.
  https://data.worldbank.org/indicator/SE.PRM.ENRR

- **Secondary School Enrollment**
  Where we sourced our data on secondary enrollment levels.
  https://data.worldbank.org/indicator/SE.SEC.ENRR

- **Tertiary School Enrollment**
  Where we sourced our data on tertiary enrollment levels.
  https://data.worldbank.org/indicator/SE.TER.ENRR

- **Importance of Tertiary School Enrollment** Motivation for why tertiary school enrollment levels are important https://www.worldbank.org/en/topic/tertiaryeducation

- **Impact of education on economic development**
  Research into importance of education in economic development and beyond
  https://www.csis.org/analysis/investing-quality-education-economic-development-peace-and-stability

- **India Education for all** Research into increases in India's education https://dsel.education.gov.in/sites/default/files/2019-05/Manual_Planning_and_Apprisal.pdf

"Afghanistan Community Schools." n.d. Educational Policy and Data Center (EPDC) PDF. https://www.epdc.org/sites/default/files/documents/Afghanistan%20Community%20Schools.pdf.

"Investing in Quality Education for Economic Development, Peace, and Stability." n.d. Center for Strategic & International Studies (CSIS). https://www.csis.org/analysis/investing-quality-education-economic-development-peace-and-stability.

"Manual for Planning and Appraisal of School Education Programs." n.d. Department of School Education & Literacy (DSEL), Government of India. https://dsel.education.gov.in/sites/default/files/2019-05/Manual_Planning_and_Apprisal.pdf.

World Bank. 2024. "Tertiary Education Overview." https://www.worldbank.org/en/topic/tertiaryeducation.

"World Development Indicators Metadata: Tertiary Enrollment." n.d. World Bank DataBank metadata glossary for series SE.TER.ENRR. https://databank.worldbank.org/metadataglossary/world-development-indicators/series/SE.TER.ENRR.