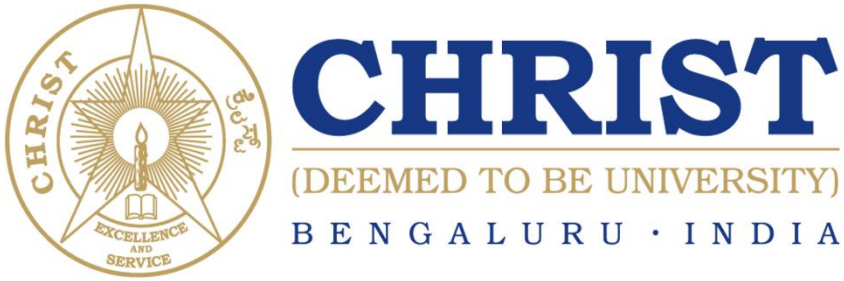

CIA

Data Visualisation

DSC 261-3

Title:

"Enhancing Quality Education: A Global Analysis of SDG Targets 4.3.1 and 4.4.1"

Submitted To:

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Submitted By:

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3BSc DS

Date of submission:

18th October,2024

ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL

A. Problem Statement

To improve the overall quality of education for all, ensuring that every individual has access to necessary skills and learning opportunities, with a focus on Sustainable Development Goal 4. This includes achieving targets 4.3.1 and 4.4.1, which aim to increase access to quality education for all individuals, particularly ensuring that youth and adults acquire relevant skills and competencies necessary for employment, lifelong learning, and personal development.

B. Introduction

This report investigates key factors influencing the quality of education worldwide, focusing on Sustainable Development Goal (SDG) 4 and its targets, 4.3.1 and 4.4.1. These targets aim to ensure equitable access to quality education and promote lifelong learning opportunities for all individuals.

The analysis includes various data points, such as student enrollment rates across different grade levels, participation by age group, and the distribution of information and communication technology (ICT) skills. By comparing India's educational quality with that of leading countries, we can identify existing gaps and areas for enhancement. The findings will guide strategies to improve educational access and outcomes, contributing to the overarching goal of achieving quality education for all.

C. Need for addressing the problem statement

Addressing the quality of education is crucial for various reasons:

1. *Universal Right:* Quality education is a fundamental right that should be accessible to everyone, regardless of their background.
2. *Economic Development:* Enhancing education directly contributes to economic growth by equipping individuals with the skills needed for better job opportunities and productivity.
3. *Equity and Inclusion:* Many marginalized groups continue to face barriers in accessing quality education. Focusing on these gaps is vital to ensure equitable educational opportunities for all.
4. *Empowerment:* A strong educational foundation empowers individuals, particularly youth and women, enabling them to make informed choices and contribute to society.
5. *Skill Development:* Incorporating ICT skills in education is essential to prepare students for the demands of the modern workforce, ensuring they are competitive in a digital economy.

6. *Sustainable Progress:* Investing in quality education leads to long-term societal benefits, including improved health outcomes, reduced poverty, and enhanced community resilience.
7. *Alignment with Global Goals:* Improving education quality aligns with the Sustainable Development Goals, particularly those aimed at ensuring inclusive and equitable quality education.

In short, enhancing education quality is essential for personal growth and the overall well-being of society.

D. Objectives

1.) ***Investigate ICT Skills Distribution****:* Examine the distribution of ICT skills among different groups to spot any disparities in access and proficiency.
2.) ***Identify Gender Disparities in Education****:* Assess differences in education participation and ICT skills between genders to ensure equal opportunities for all.
3.) ***Analyze Student Enrollment Trends****:* Look at the enrollment rates across different grades to find patterns and areas that need attention.
4.) ***Evaluate Age Group Participation****:* Assess how different age groups are participating in education to see where access may be lacking, especially for older students.
5.) ***Compare India's Educational Quality****:* Compare the quality of education in India with that of top-performing countries to identify gaps and areas for improvement.
6.) ***Address the Digital Divide****:* Identify factors that contribute to the digital divide in India and suggest ways to improve ICT access for underserved communities.
7.) ***Forecast Future Educational Quality Trends****:* Predict future changes in educational quality based on current data to help guide policy and strategy decisions**.**
8.) ***Monitor Improvements in Educational Access****:* Track changes in educational access and quality over time to measure progress toward achieving SDG 4.3.1 and 4.4.1.

E. Analysis

E.1 Data Sources and Preparation:

For this analysis, two key datasets were used to explore global educational quality and ICT skill access:

1. **Dataset Provided in google classroom**:

   Columns:Goal, Target, Indicator, SeriesCode, SeriesDescription, GeoAreaCode, GeoAreaName, TimePeriod, Value, Time_Detail, Source, Sex, Type of Skill, Level of Grade, Reporting Type, Units, Nature, Age

Purpose: This dataset provided detailed data on SDG Goal 4, focusing on educational enrollment, ICT skills, and demographic factors like gender.

2. **World Bank Dataset**:

   Columns:GeoAreaCode, ICT Skill Access, Proficiency Value, Education Quality Index, Education Type, Series Code, Level of Grade, Type of Education

   Purpose: This dataset was used for global comparisons and included key indicators such as ICT skill access, proficiency levels, and the Education Quality Index across countries.

E.2 Data Cleaning:

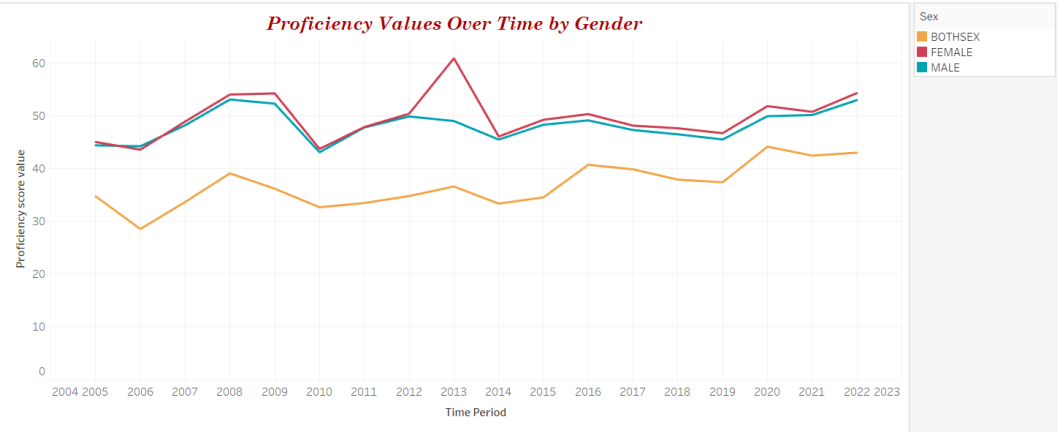
- Empty Columns:
  Many columns in the dataset provided were empty, such columns were deleted.
- Handling Missing Values:
  Missing values in the dataset, particularly in the ICT Skill Access, Value, and Education Quality Index fields, were filled using the mean value of the respective columns to maintain consistency in the analysis.

E.3 Analysing Criteria:

Sex, Country, Age, Education quality, ICT Skills, Proficiency Value,Time period.

E.4 Analysis of the charts and findings:

Chart 1:



Caption

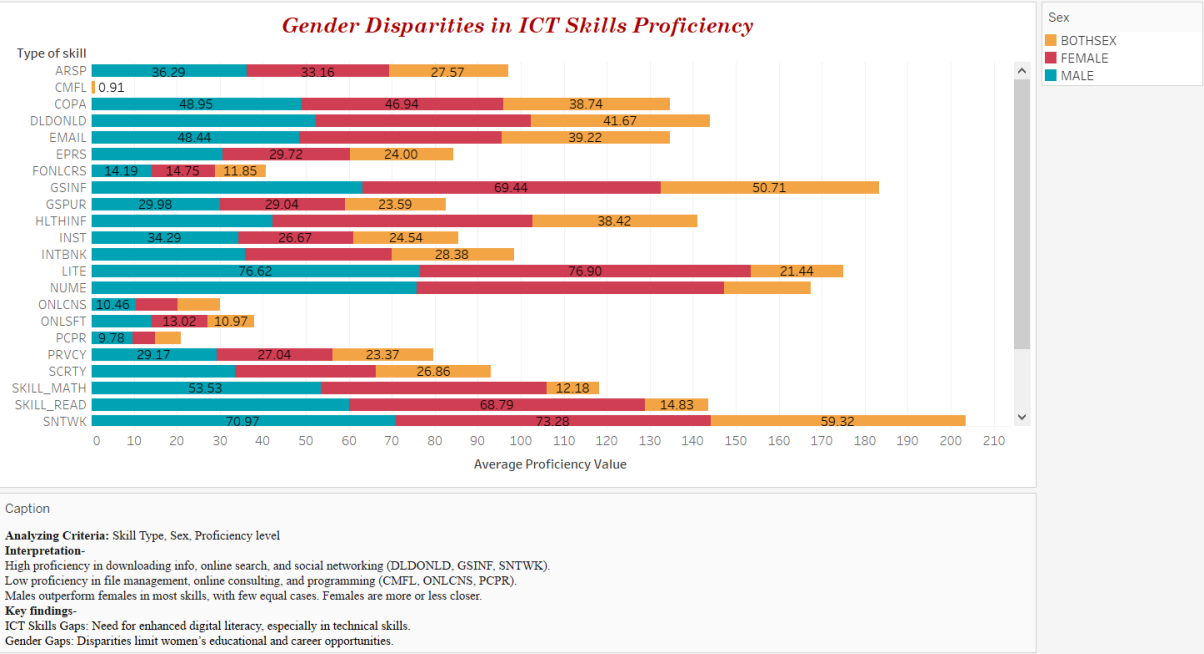
Analyzing Criteria: Time Period,Proficiency Value,Sex
Interpretation:
Males and females have nearly equal proficiency values, with females slightly higher.
In 2013, females outperformed males.Some countries reported gender data as "both."
Key Findings (SDG Goal 4):
Gender Equality: Similar proficiency indicates progress toward gender equality in education.
Inclusivity Focus: Ensure equal educational opportunities for all genders.
Targeted Programs: Address gaps through focused educational initiatives.

Line graph with x-axis: time period , y-axis :proficiency value, color: sex

Key findings:

- Both lines (for males and females) show a steady increase in ICT skills until 2013, where growth peaks.
- After 2013, the growth of ICT skills slows down for both genders.
- There is minimal difference between the male and female lines, indicating a similar level of proficiency over time.
- This chart answers Objective 1 and 2
- The chart shows that the development of ICT skills is largely gender-neutral, as both males and females have similar proficiency levels throughout the years.

Chart 2:



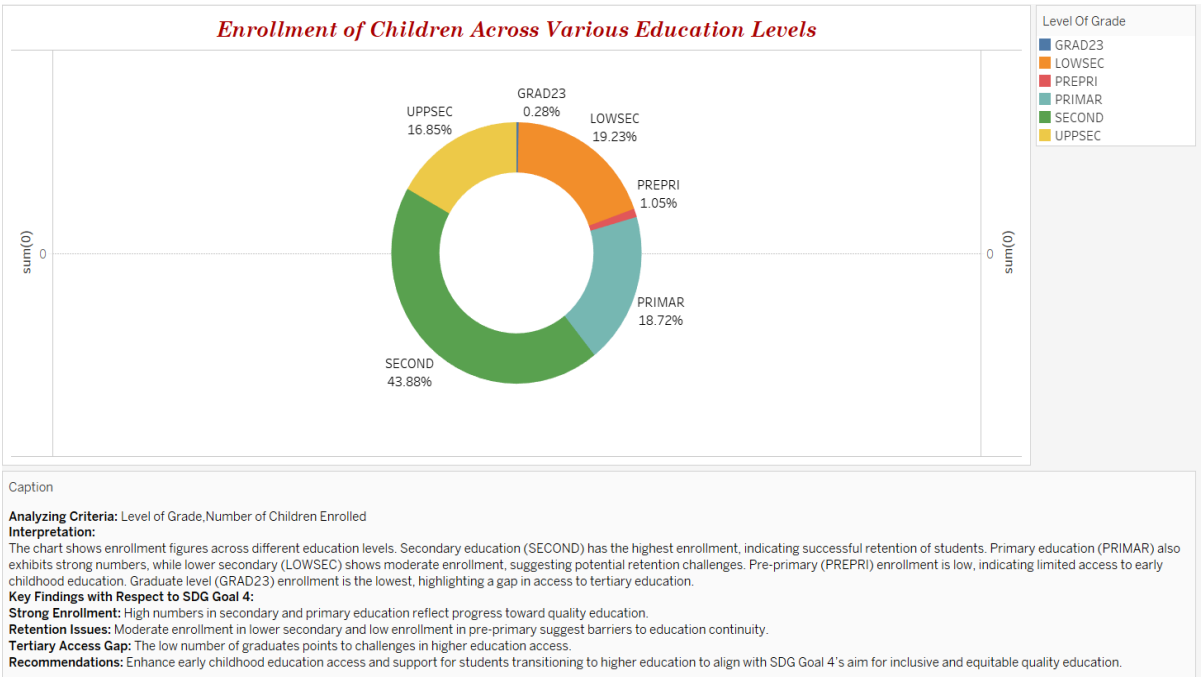
Stacked bar chart with average of value on columns and tye of skill in rows and sex in color

- Skills Overview: High proficiency in downloading information, online searching, and social networking shows strong basic ICT skills. However, low proficiency in file management, online consulting, and programming highlights significant technical skill gaps.
- Gender Disparity: Males generally outperform females in most ICT skills, indicating a troubling disparity that limits women's educational and career opportunities.
  Key Findings:

- ICT Skills Gaps: There is a critical need for enhanced digital literacy in both formal and informal education, particularly in programming.

- Gender Gaps: The skills disparity restricts women's access to technology fields, necessitating initiatives to promote women's participation in ICT education and careers.
- This chart answers objectives 1 and 2

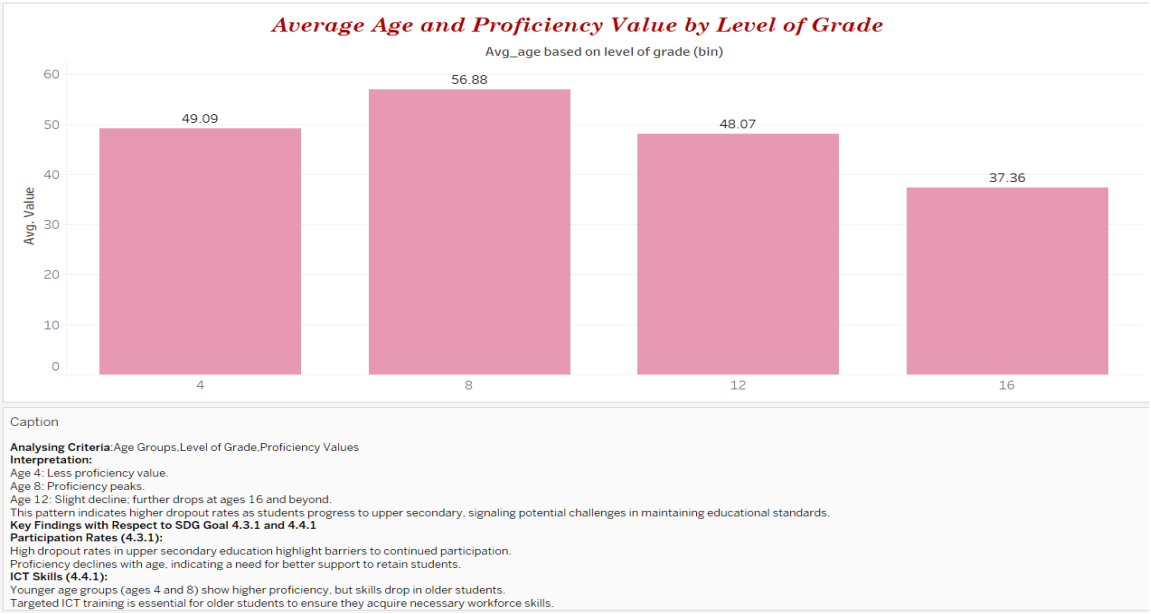
Chart 3:



Donut chart the level of grade taken as proportion and their count as angle

- The donut chart illustrates student enrollment across various grades.
- Grades at the primary and secondary levels show strong participation, with second grade having the highest enrollment, while higher education levels (e.g., Grad23) have the lowest.
- This trend reflects the challenges of retaining students through higher levels of education, aligning with SDG Target 4.3.1, which emphasizes improved access to education at all levels.
- This chart answers the objective 3.

Chart 4:

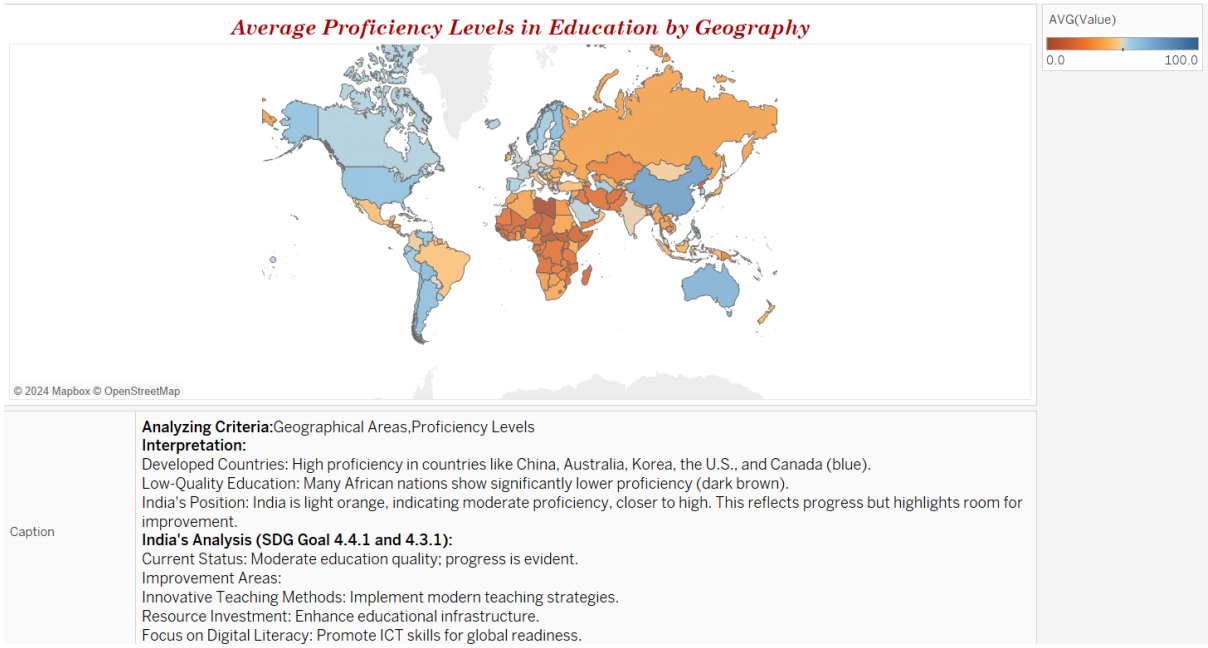


Line chart that shows the age group wise the proficiency value level.

Age group was created using a calculated field based on level of grade.

- Analysis of age group participation shows peak enrollment at ages 4 and 8, but a sharp decline at ages 16 and above.
- This suggests a need for targeted interventions for older students to prevent dropouts and ensure they gain the skills necessary for employment, in line with SDG Target 4.4.1.
- This chart answers the objective 4.

Chart 5:



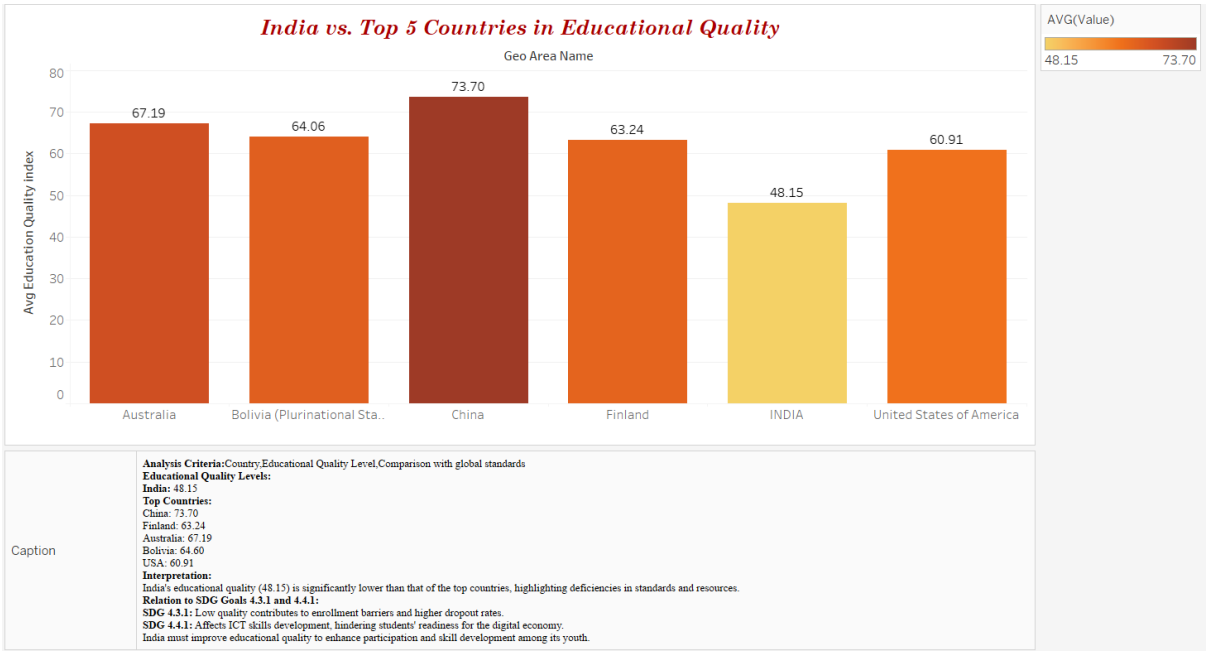
Geoplot chart with proficiency value in the colors section

- The geographical plot compares educational quality globally.
- Developed nations, represented in blue, have the highest educational quality, while countries in Africa, represented by dark brown, lag behind.
- India, shown in light orange, falls in the middle range, indicating the need for improvements to compete with top-performing nations.
- This aligns with India's goal of enhancing its education sector to meet international standards.
- This charts answers objective 5

E.5 Analysis of India separately with other countries

From the above geoplot as well we can get an idea about India and compare with other countries.

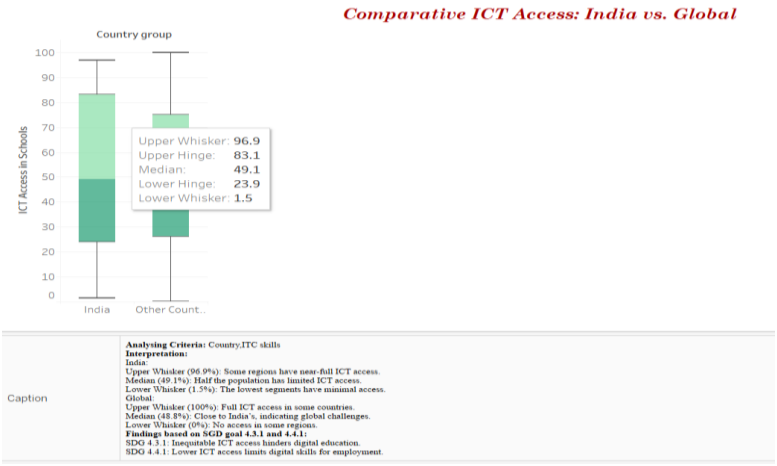
Chart 6:



Bar chart comparing India's educational quality index with the top 5 countries which were obtained using filters option.

- The bar chart comparing educational quality reveals that India's average score is 48.15, significantly lower than leading countries like China (73.70), Australia (67.19), Bolivia(64.06),Finland (63.24), and the U.S. (60.91).
- This stark contrast underscores the urgency for India to enhance its educational standards to meet international benchmarks, aligning with SDG 4's overarching goal of ensuring inclusive and equitable quality education.
- This chart answers the objective 5.

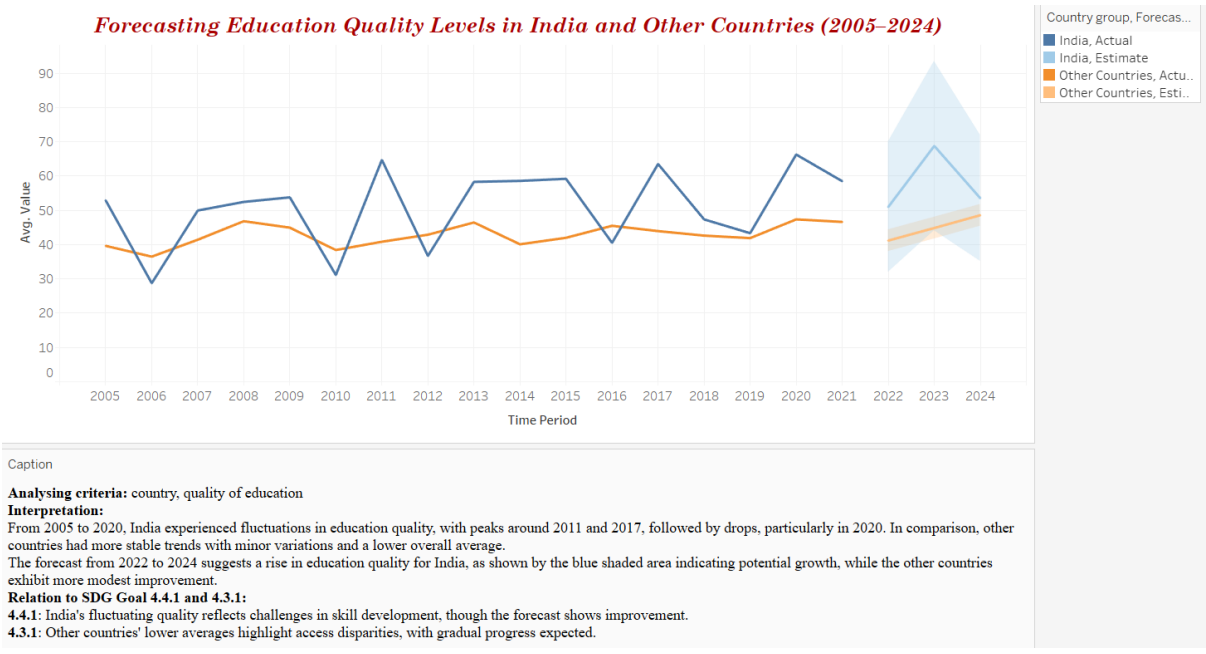
Chart 7:



A boxplot was created to compare India's ICT access with other countries by establishing a calculated field called "country group," which distinguishes between India and the rest of the countries.

- The boxplot analysis of ICT access shows a wide disparity in access across regions in India. While some areas exhibit nearly full access (upper whisker at 96.9%), the median indicates that 50% of the population has limited access (median at 49.1%), with some segments experiencing minimal access (lower whisker at 1.5%).
- This inequity highlights the importance of addressing the digital divide to fulfill SDG 4.3.1 and 4.4.1, which emphasize equal access to education and ICT skills for all individuals.
- This chart answers the objective 5 and 6.

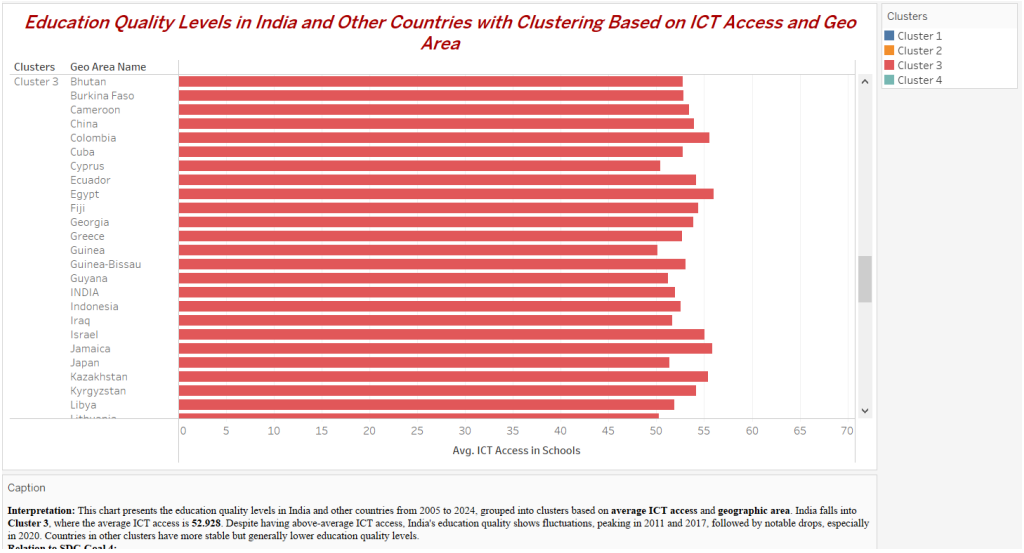
Chart 8:

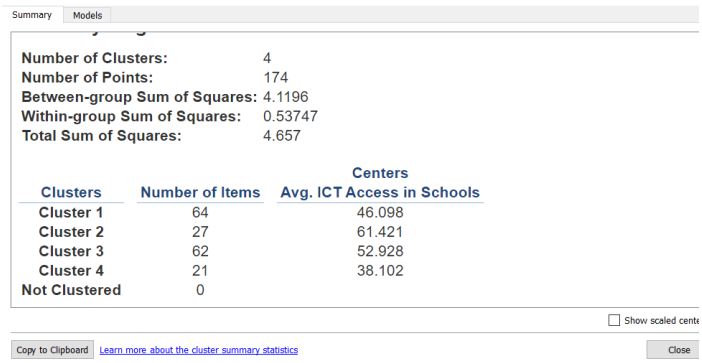


Forecasting the future trend in the education quality index specifically for India and other countries overall using line chart with the time period in the x-axis and the average value in the y axis.

- The forecasting chart indicates a potential rise in educational quality in India from 2022 to 2024, suggesting that ongoing reforms and initiatives may lead to improvements.
- Other countries also show gradual increases, indicating a global trend towards enhancing educational quality.
- This indicates potential progress but also the need for accelerated efforts.
- This data is essential for policymakers to develop targeted strategies that ensure continued progress.
- This chart answers the objectives 5 and 7.

Chart 9:





Cluster analysis divides countries into four categories based on educational quality.

- India is placed in Cluster 3, representing average performance, while Cluster 1 includes countries with the highest educational quality.
- This chart presents the education quality levels in India and other countries from 2005 to 2024, grouped into clusters based on average ICT access and geographic area. India

falls into Cluster 3, where the average ICT access is 52.928. Despite having above-average ICT access, India's education quality shows fluctuations, peaking in 2011 and 2017, followed by notable drops, especially in 2020. Countries in other clusters have more stable but generally lower education quality levels.

- **Relation to SDG Goal 4:**
- **4.4.1** (Skills for Employment): India's fluctuating education quality highlights the need to improve skill development. Although India has relatively good ICT access, the uneven application may be contributing to inconsistent educational outcomes.
- **4.3.1** (Equal Access to Education): The clustering shows disparities in ICT access between countries. While Cluster 3, including India, has better access, further efforts are needed to ensure ICT is fully utilized to support equitable, quality education for all.
- This highlights India's need to learn from high-performing nations to enhance its education system.

F. Interpretation

Based on the analysis above, several key insights related to Sustainable Development Goals (SDG) 4.3.1 and 4.4.1 emerge:

1. **Equity in Access**: The boxplot illustrates disparities in ICT access across regions in India. While some areas enjoy nearly full access, many remain underserved, highlighting the need for targeted interventions to achieve equitable access to education and ICT skills (SDG 4.3.1).
2. **Skills Development**: Gender disparities in ICT skills show that males generally outperform females, impacting women's educational and career opportunities. This aligns with SDG 4.4.1, which emphasizes the importance of skills acquisition for personal and professional growth.
3. **Enrollment Trends**: There is a decline in enrollment at higher education levels, indicating challenges in student retention. Addressing this issue is crucial for achieving SDG 4.3.1, which seeks to ensure quality education at all levels.
4. **Forecasting Trends**: The analysis suggests a potential rise in educational quality in India, indicating that ongoing reforms may lead to positive outcomes. Policymakers should use this data to sustain and accelerate progress across all demographics.
5. **Global Comparisons**: Comparing India's educational quality with top-performing countries highlights the need for significant improvements. By learning from successful models elsewhere, India can better align with SDG 4's goal of inclusive quality education.
6. **Focus on India**: India is placed in Cluster 3, indicating average educational quality despite good ICT access. To align with SDG 4.4.1, India needs to enhance skill development and educational quality, particularly for underserved communities.
7. **Measures for Improvement**:

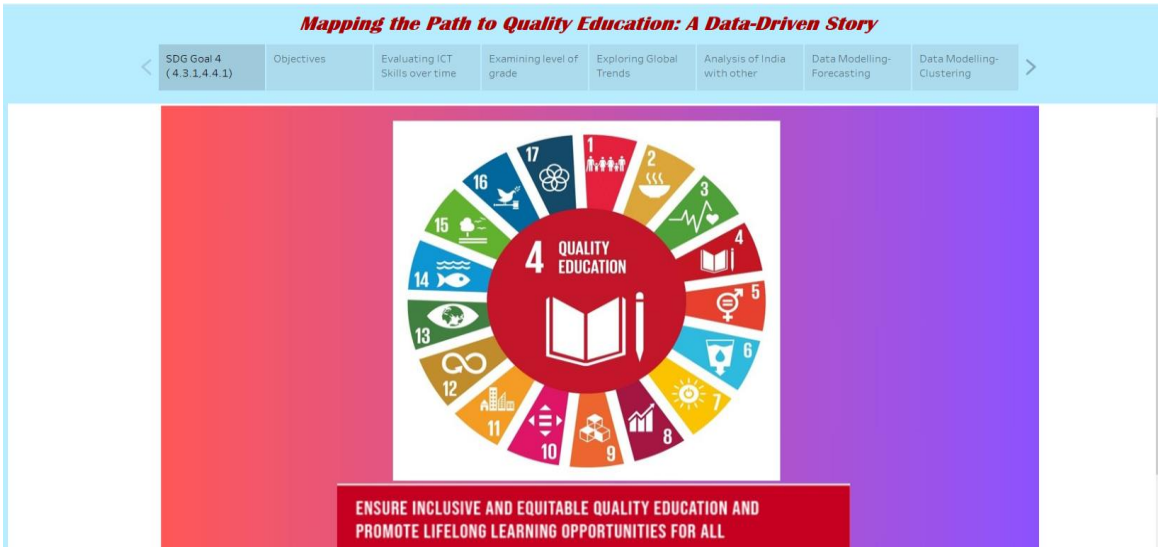
- Targeted ICT Training: Launch digital literacy programs globally.
- Gender-Inclusive Policies: Promote female participation in STEM fields.
- Curriculum Enhancement: Update curricula to include essential modern skills.
- Public-Private Partnerships: Foster collaborations for educational infrastructure investment.

G.Concepts Covered

This project utilized various data analysis and visualization techniques:

- **Charts**: Employed various chart types (line graphs, bar charts, donut charts, boxplots) to visually represent and interpret data.
- **Exploratory Data Analysis (EDA)**: Conducted EDA to identify patterns and trends within the educational data.
- **Calculated Fields**: Created calculated fields, such as "country group," to facilitate comparative analysis.
- **Hierarchical Grouping**: Grouped data hierarchically to analyze trends across different levels, such as age and education type.
- **Perspective Analysis using Forecasting**: Used forecasting techniques to predict future trends in educational quality based on current data.
- **Clustering**: Conducted cluster analysis to categorize countries based on educational quality and ICT access, aiding in comparative insights.
- **Dashboards and Data Storytelling**: Developed a cohesive narrative around the data to communicate findings effectively, focusing on how they relate to SDG 4.

H. Final Story Picture



Mapping the Path to Quality Education: A Data-Driven Story

SDG Goal 4 (4.3.1,4.4.1) | Objectives | Evaluating ICT Skills over time | Examining level of grade | Exploring Global Trends | Analysis of India with other | Data Modelling-Forecasting | Data Modelling-Clustering

Objectives:

1. Evaluate ICT Proficiency: Assess overall ICT skill levels across age groups and countries.
2. Analyze Gender Gaps: Examine proficiency differences between male and female students.
3. Explore Global Trends: Investigate geographic variations in education quality and ICT access.
4. Compare India's Education: Analyze India's education quality against top-performing countries.
5. Examine Age Trends: Study the impact of age on educational outcomes and dropout rates.
6. Assess ICT Access: Evaluate levels of ICT access in India and globally.
7. Analyze Quality Fluctuations: Review changes in education quality in India over time.
8. Identify Improvement Areas: Highlight recommendations for enhancing education quality.

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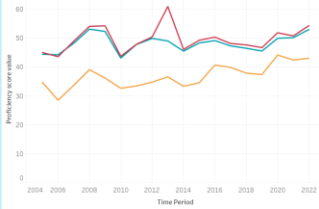
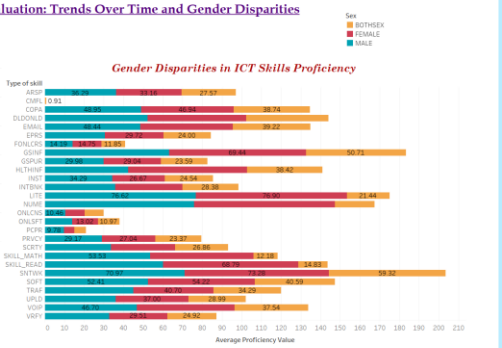
Global ICT Skill Evaluation: Trends Over Time and Gender Disparities

Proficiency Values Over Time by Gender



Gender Disparities in ICT Skills Proficiency



Gender-wise ICT Skills: Males outperform females in some skills, while in others, proficiency levels are nearly equal across genders.
ICT Skills Over Time: Global ICT skills are improving overall, but the rate of progress varies by specific skill.
SDG 4.3.1: Emphasizes the need for equal access to technical education for both genders.
SDG 4.4.1: Growth in ICT skills aligns with the goal, but attention is needed to address disparities in specific skills.

STORY | Skills by gender | Skill over time | Geo proficiency | levels of grade | age groups | India Vs other analysis | ICT access-India Vs Global | Data modeling-1 | Data modeling-2 | Dashboard 1 | Dashboard 2 | Dashboard 3 | Dashbo

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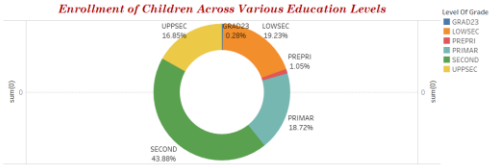
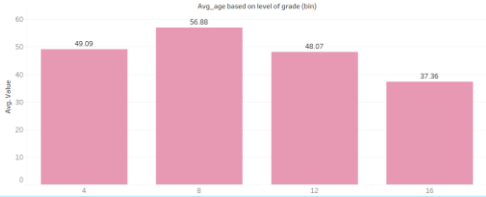
Enrollment of Children Across Various Education Levels



Analysis: Higher enrollment is seen in primary and secondary levels, with sharp declines in graduate levels. Younger age groups (4-8 years) have better enrollment, but dropout rates rise for ages 16-18.
Relation to SDG Goal 4
4.3.1: Declining enrollment and dropouts limit access to quality education.
4.4.1: Lower retention in older age groups hinders skill development for future employment.

Average Age and Proficiency Value by Level of Grade



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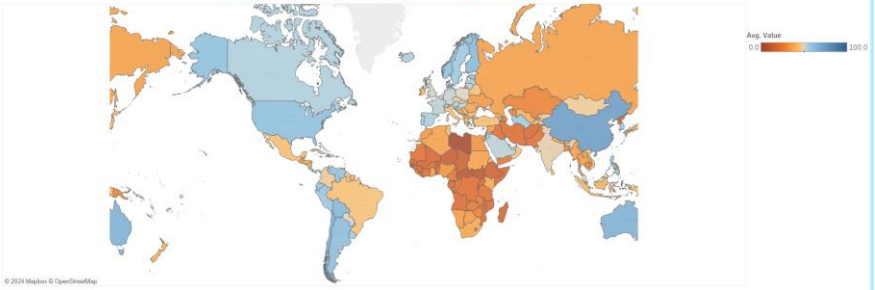
Average Proficiency Levels in Education by Geography



Analysis: Developed countries like China, Australia, Bolivia, and the U.S., shown in blue on the geoplot, have higher education quality. In contrast, many African nations, depicted in darker brown, have significantly lower quality levels. India, in a light orange shade, falls in the middle, indicating room for growth.
Relation to SDG Goal 4
4.3.1: Disparities in access to quality education limit equal opportunities.
4.4.1: Countries with lower education quality need targeted efforts to enhance skills for employment.

STORY | Skills by gender | Skill over time | Geo proficiency | levels of grade | age groups | India Vs other analysis | ICT access-India Vs Global | Data modeling-1 | Data modeling-2 | Dashboard 1 | Dashboard 2 | Dashboard 3 | Dashbo

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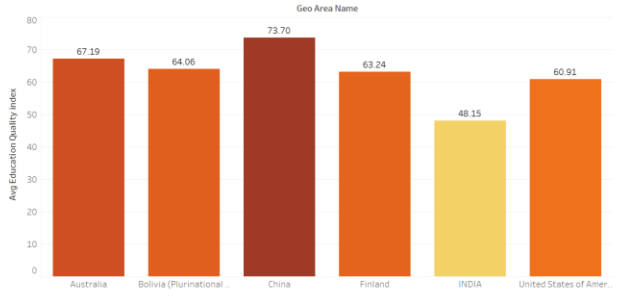
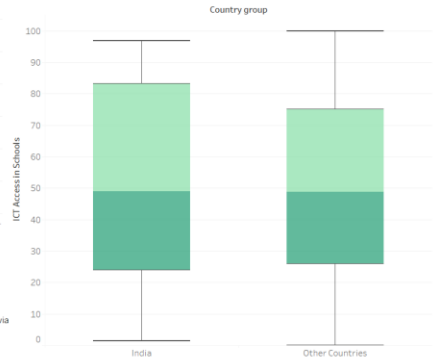
India vs. Top 5 Countries in Educational Quality



Avg. Value
48.15 73.70

Boxplot Analysis:
The boxplot shows ICT skills in India, with an upper whisker of 96.9% indicating regions with near-full access, while the median stands at 49.1%, reflecting limited access for half the population. The lower whisker (1.5%) reveals minimal access in some areas. Globally, the upper whisker reaches 100%, with a median of 48.8%, highlighting similar challenges.
India vs Top 5 Countries:
India's education quality score of 48.15 lags behind top countries: China (73.70), Australia (67.19), and Bolivia (64.60). This gap indicates significant room for improvement in education quality.
SDG Impact:
India must implement strategies to enhance ICT access and education quality, bridging the gap with leading nations to achieve equitable and inclusive education for all.

Comparative ICT Access: India vs. Global



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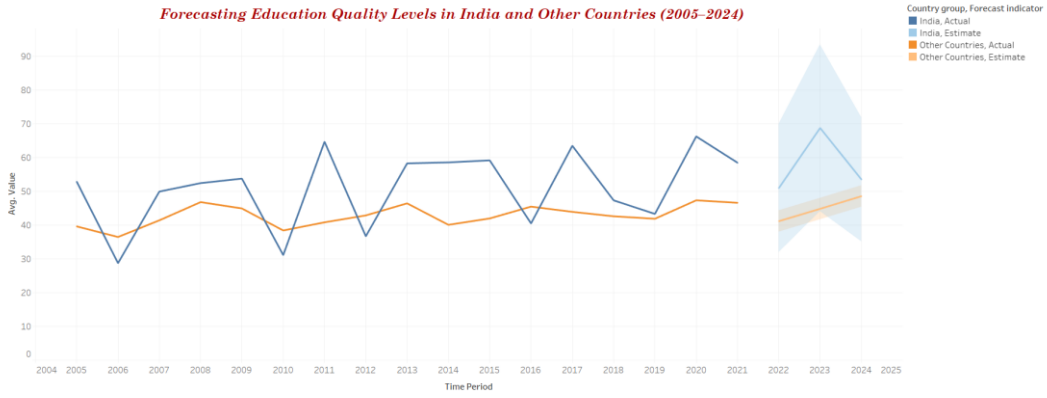
SDG Goal 4 (4.3.1,4.4.1) | Objectives | Evaluating ICT Skills over time | Examining level of grade | Exploring Global Trends | Analysis of India with other | Data Modelling-Forecasting | Data Modelling-Clustering

Forecasting Education Quality Levels in India and Other Countries (2005–2024)



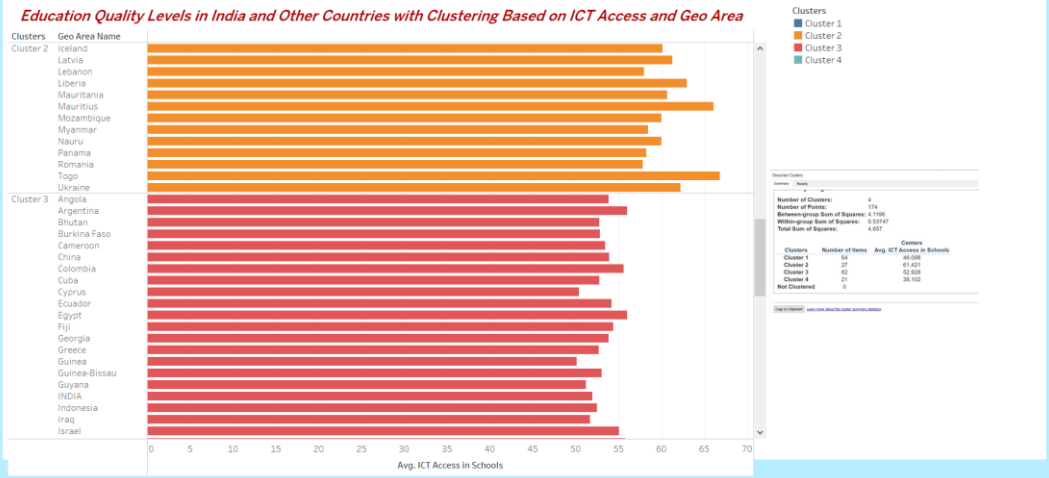
The forecasting chart indicates that India experienced fluctuations in education quality from 2005 to 2020, with notable peaks in 2011 and 2017, but a decline in 2020. The forecast for 2022 to 2024 suggests a potential rise in education quality, indicating positive trends for the future.
SDG Impact:
Achieving Goal 4.4.1, which focuses on improving education quality and skills development, is crucial for India. The anticipated growth in education quality underlines the need for effective strategies to enhance skill development and educational outcomes, ensuring equitable access to quality education for all.

STORY | Skills by gender | Skill over time | Geo proficiency | levels of grade | age groups | India Vs other analysis | ICT access-India Vs Global | Data modelling-1 | Data modelling-2 | Dashboard 1 | Dashboard 2 | Dashboard 3 | Dashbc

Mapping the Path to Quality Education: A Data-Driven Story

SDG Goal 4 (4.3.1,4.4.1) | Objectives | Evaluating ICT Skills over time | Examining level of grade | Exploring Global Trends | Analysis of India with other | Data Modelling-Forecasting | Data Modelling-Clustering

Education Quality Levels in India and Other Countries with Clustering Based on ICT Access and Geo Area



STORY | Skills by gender | Skill over time | Geo proficiency | levels of grade | age groups | India Vs other analysis | ICT access-India Vs Global | Data modelling-1 | Data modelling-2 | Dashboard 1 | Dashboard 2 | Dashboard 3 | Dashbc

I.Conclusion

This report highlights the urgent need to enhance global education quality, focusing on Sustainable Development Goals (SDG) 4.3.1 and 4.4.1. The analysis highlights significant disparities in ICT access and educational quality, particularly in India, where targeted improvements are necessary for equitable opportunities.

To elevate educational outcomes, it's crucial to address gender disparities, promote student retention, and learn from successful global models. Key measures include implementing digital literacy programs, fostering inclusive policies, and forming public-private partnerships.

Despite progress in ICT access, India's educational quality remains below that of top-performing countries, requiring prioritized interventions. Ultimately, improving education quality is essential for individual empowerment and societal development, aligning with the global commitment to inclusive and equitable education for all.

J.References & Bibliography

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