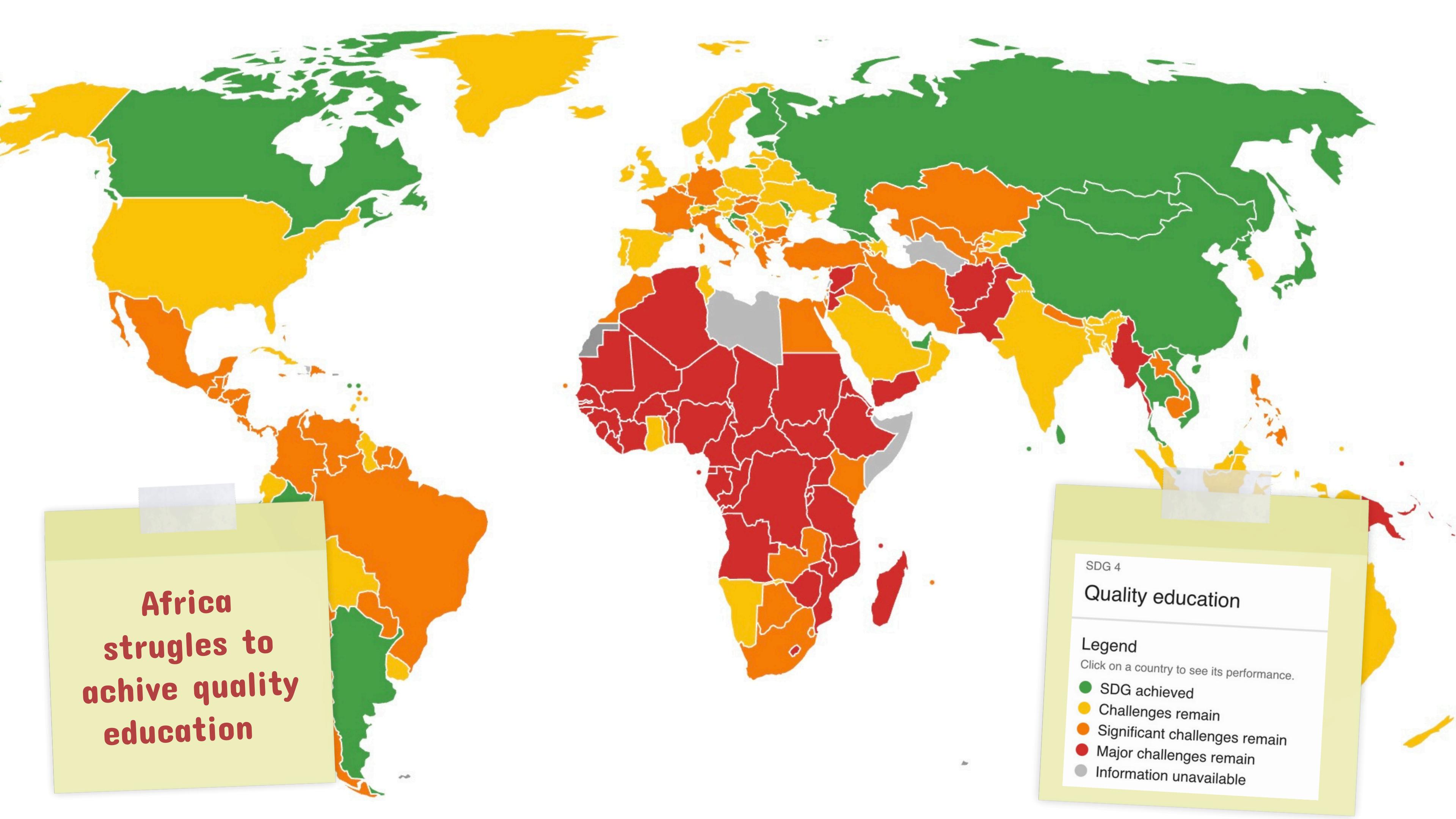


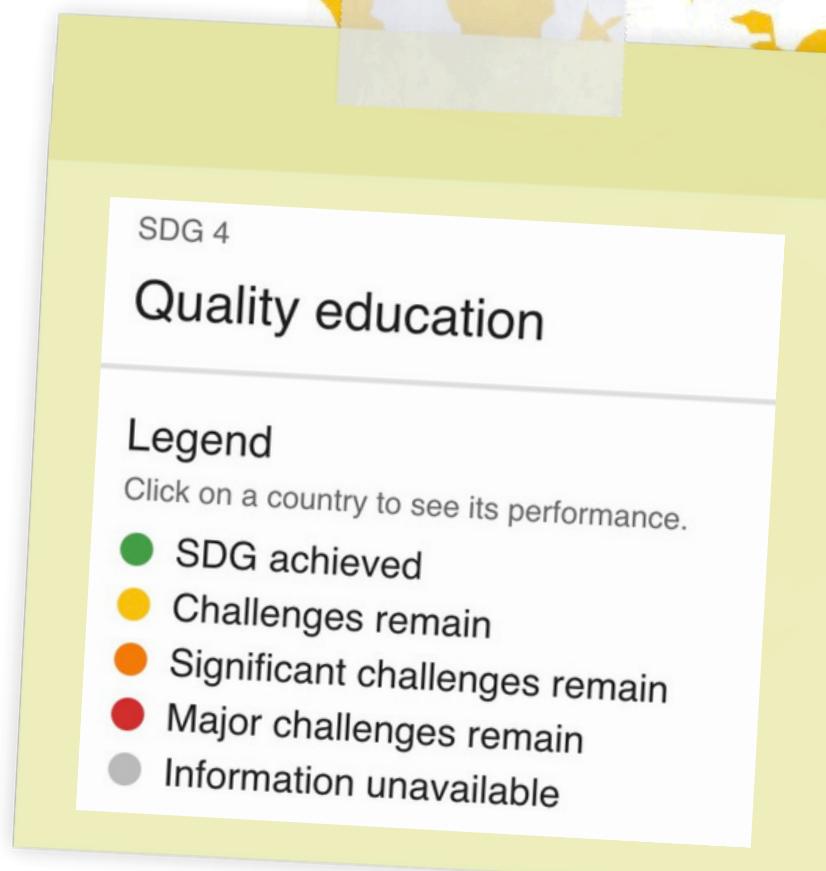
# Quatlity Education and the Connection to Gender Equality in Africa

Connecting  
SDG 4 and 5

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Yuting Jiang &  
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Africa  
struggles to  
achieve quality  
education

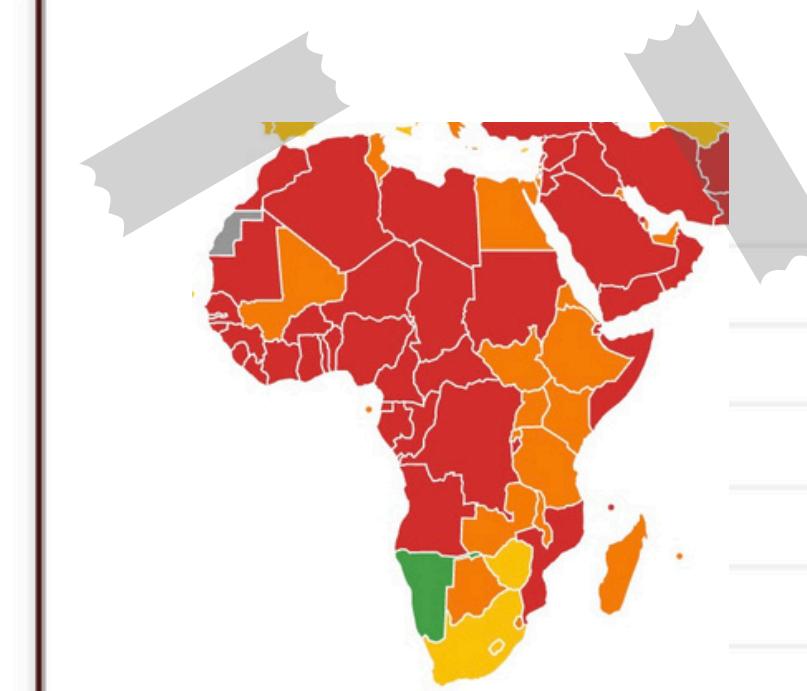


# Creating Our Question

We asked:

**How does gender equality within African countries affect the achievement of the Quality Education SDG?**

**Since we noticed an overlap in progress from the maps ->**



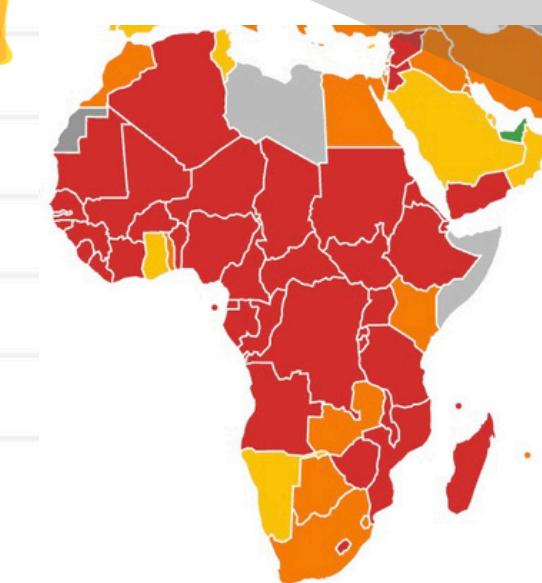
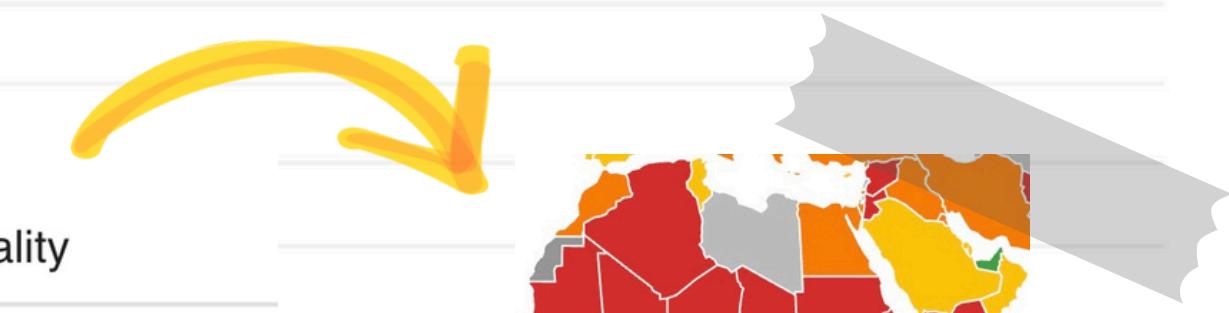
SDG 4  
Quality education

Legend  
Click on a country to see its performance.  
● SDG achieved  
● Challenges remain  
● Significant challenges remain  
● Major challenges remain  
● Information unavailable



SDG 5  
Gender equality

Legend  
Click on a country to see its performance.  
● SDG achieved  
● Challenges remain  
● Significant challenges remain  
● Major challenges remain  
● Information unavailable



## Research Question

01

**Are there specific groups of African countries with similar Quality Education SDG scores and Gender Inequality Index scores?**

The Gender Inequality Index (GII) is part of the human development report from the UN measuring gender based inequality combining multiple SDGs. This question looks to analyze how similarities between countries on the GII effect SDG 4.

## Data used

from country\_codes.csv

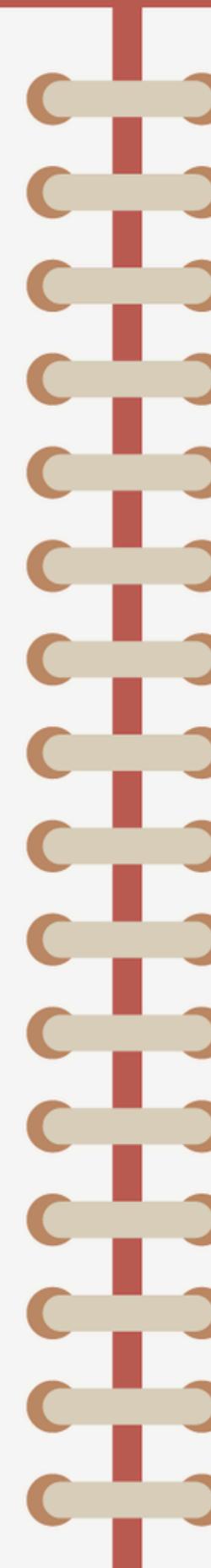
**region\_names**

-list of continent country

from country\_indicators.csv

**hdr\_gii\_2021**

-gii score in 2021  
-lower score means less  
inequality



from sdr\_fd5e4b5a.csv

**SDG 4 score**

-measures quality education  
-achievement of SDG 4 goals

# Data Wrangling Method:

Select

Rename

Filter

Clean missing data

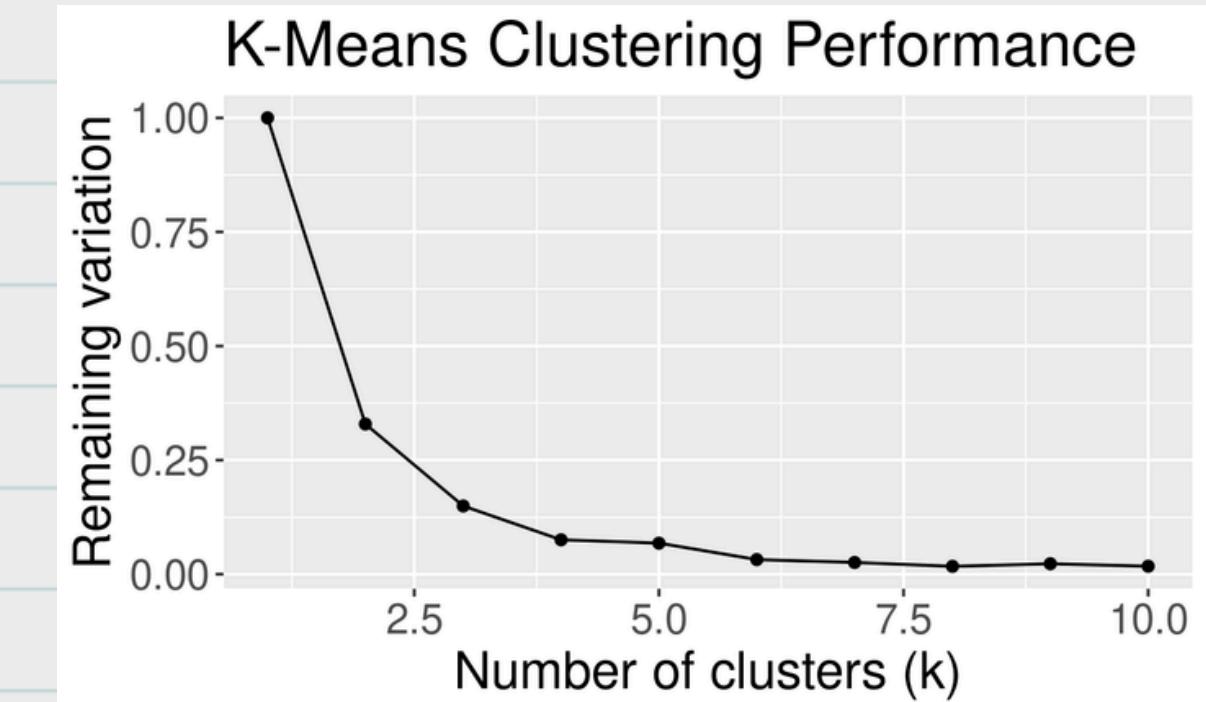
“Right\_join” to combine together

# Methodology: K-means Clustering

## Asumptions and Justications

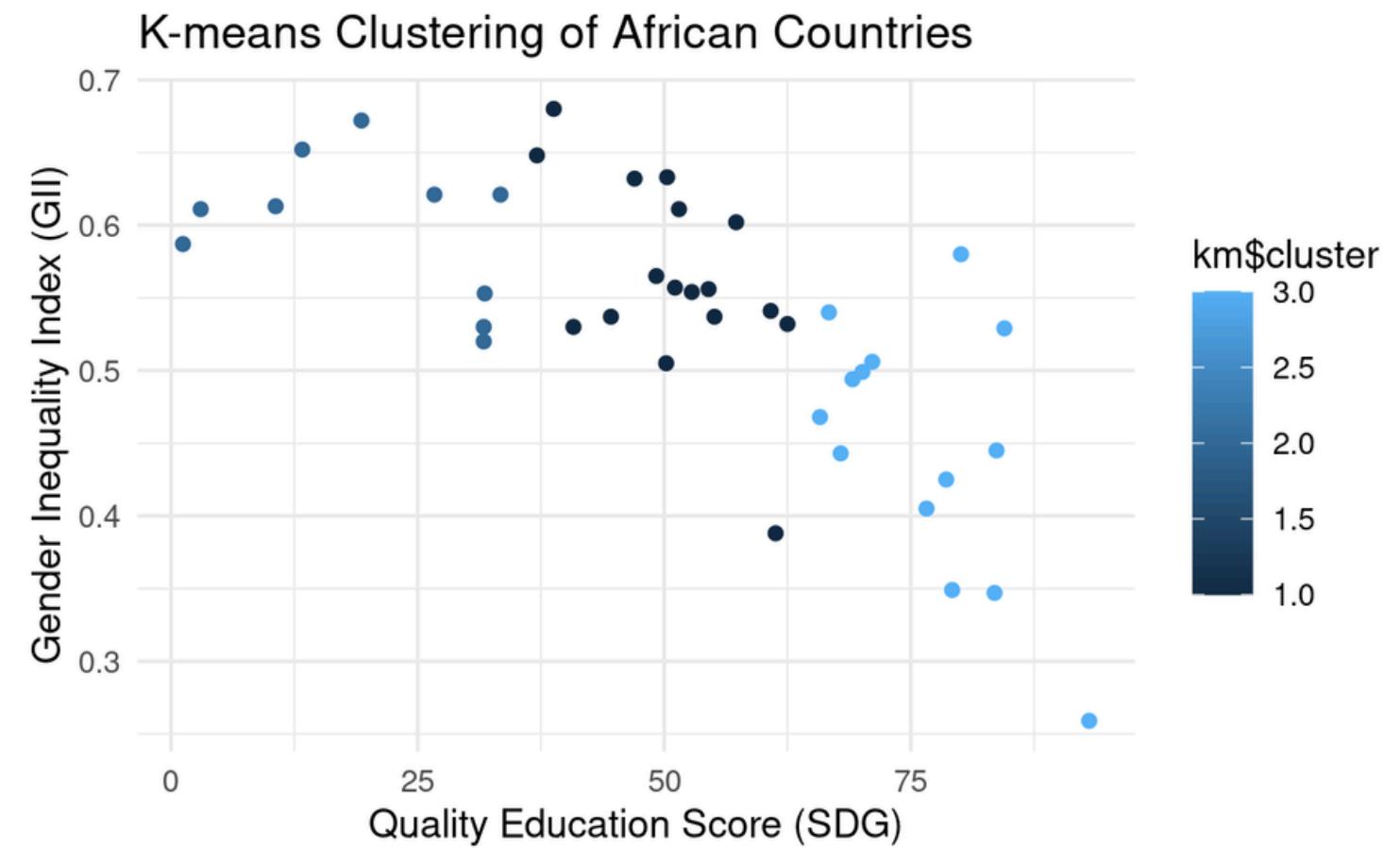
- this methodology was used to create clusters of countries with similar GII and SDG 4 scores
- Using the elbow method to find the optimal k - 3 groups were created

```
explained_ss <- rep(NA, 10)
# Perform K-means clustering for different values of k
for (k in 1:10) {
  clustering <- kmeans(cluster_data, centers = k)
  explained_ss[k] <- clustering$betweens / clustering$totss
}
# Plot the Elbow Method
ggplot() +
  aes(x=1:10, y=1-explained_ss) +
  geom_line() +
  geom_point() +
  labs(x="Number of clusters (k)",
       y="Remaining variation",
       title="K-Means Clustering Performance") +
  theme(text=element_text(size=18))
```

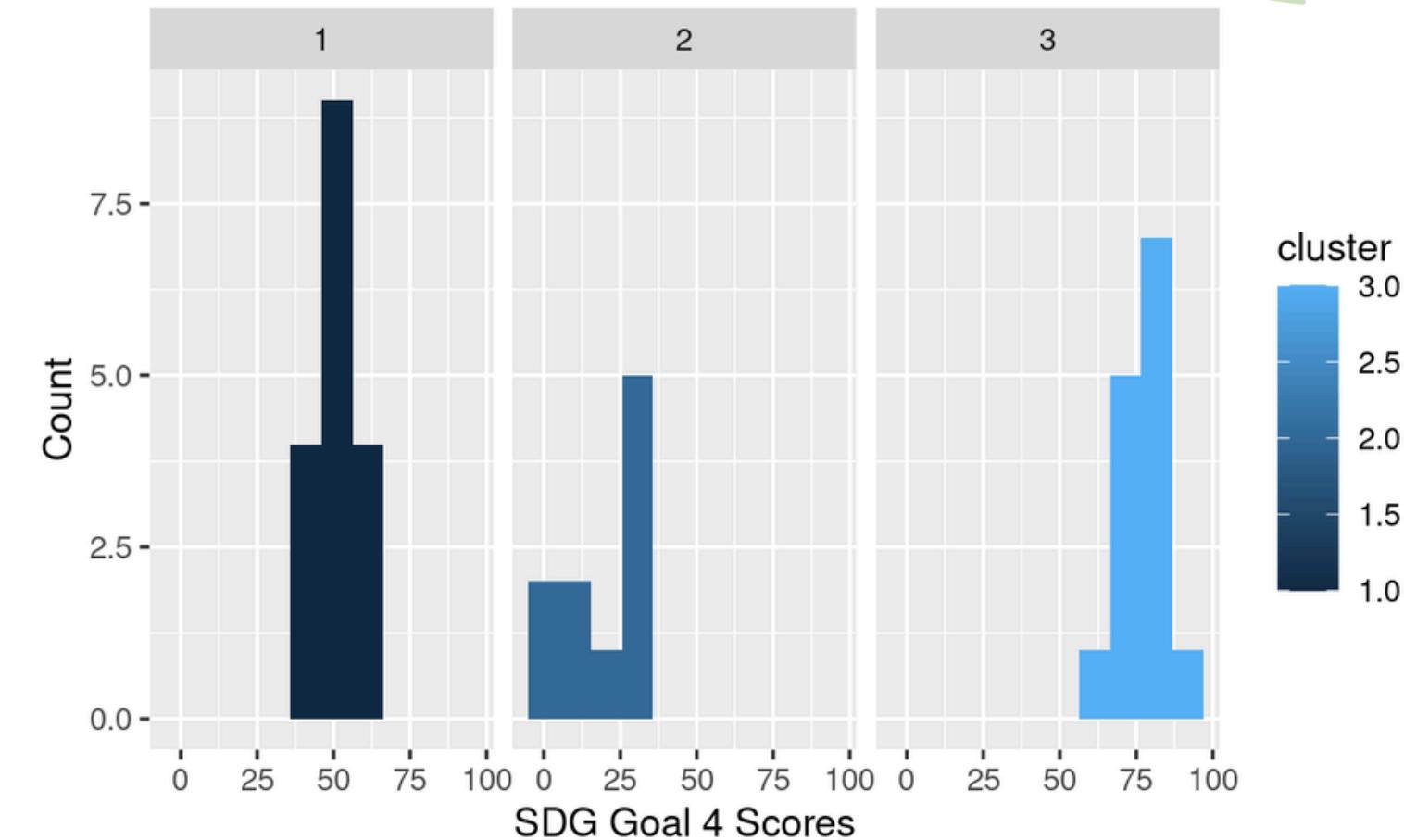


# Visualizations

01



In the 3 groups: blue has high gender inequality and low SDG 4 scores, dark blue has high gender inequality and medium SDG 4 scores, and light blue has medium gender inequality and high SDG 4 scores. The entire plot tends to be a decreasing trend.



This clustering is appropriate and useful because countries in the blue and dark blue groups could work to improve gender inequality which may help their SDG 4 scores.

## Research Question

02

In African countries, are there differences  
in early childhood education attendance  
rates across males and females from 2013  
to 2021?

Differences in attendance based off gender in early childhood  
can indicate an inequitable educational system.

# Data used

From country\_codes.csv

## **region\_name**

-lists continent country is in

## **country\_name**

-lists the name of the country

## **country\_label**

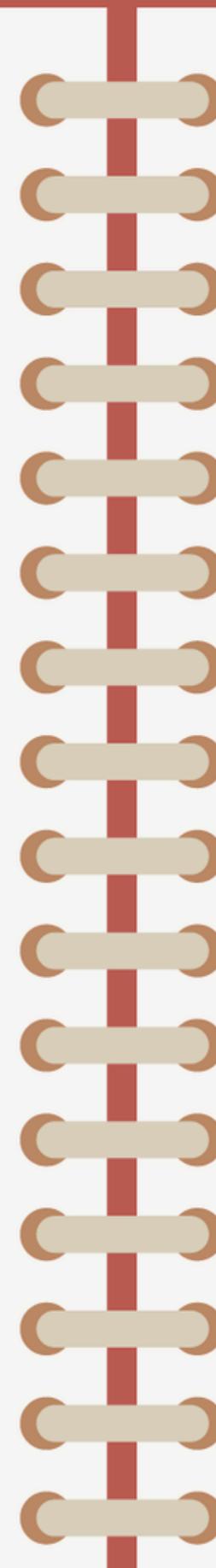
-lists the name of the country

from country\_indicators.csv

**next: clean data to find the value of African countries:**

```
Rename 'Region Code (M49)' to 'Region_name'  
country_codes <- rename(country_codes, Region_name = "Region Code  
M49")
```

```
Filter for the region code '2' which we assume represents Africa  
african_region_codes <- filter(country_codes, Region_name == 2)
```



sowc\_early-childhood-development\_\_attendance-in-early-childhood-education-2013-2021-r\_female

-measures attendance rates for females

sowc\_early-childhood-development\_\_attendance-in-early-childhood-education-2013-2021-r\_total

-measures attendance rates for all children

sowc\_early-childhood-development\_\_attendance-in-early-childhood-education-2013-2021-r\_male

-measures attendance rates for males

# Methodology:

## Hypothesis testing

### Asumptions and Justications

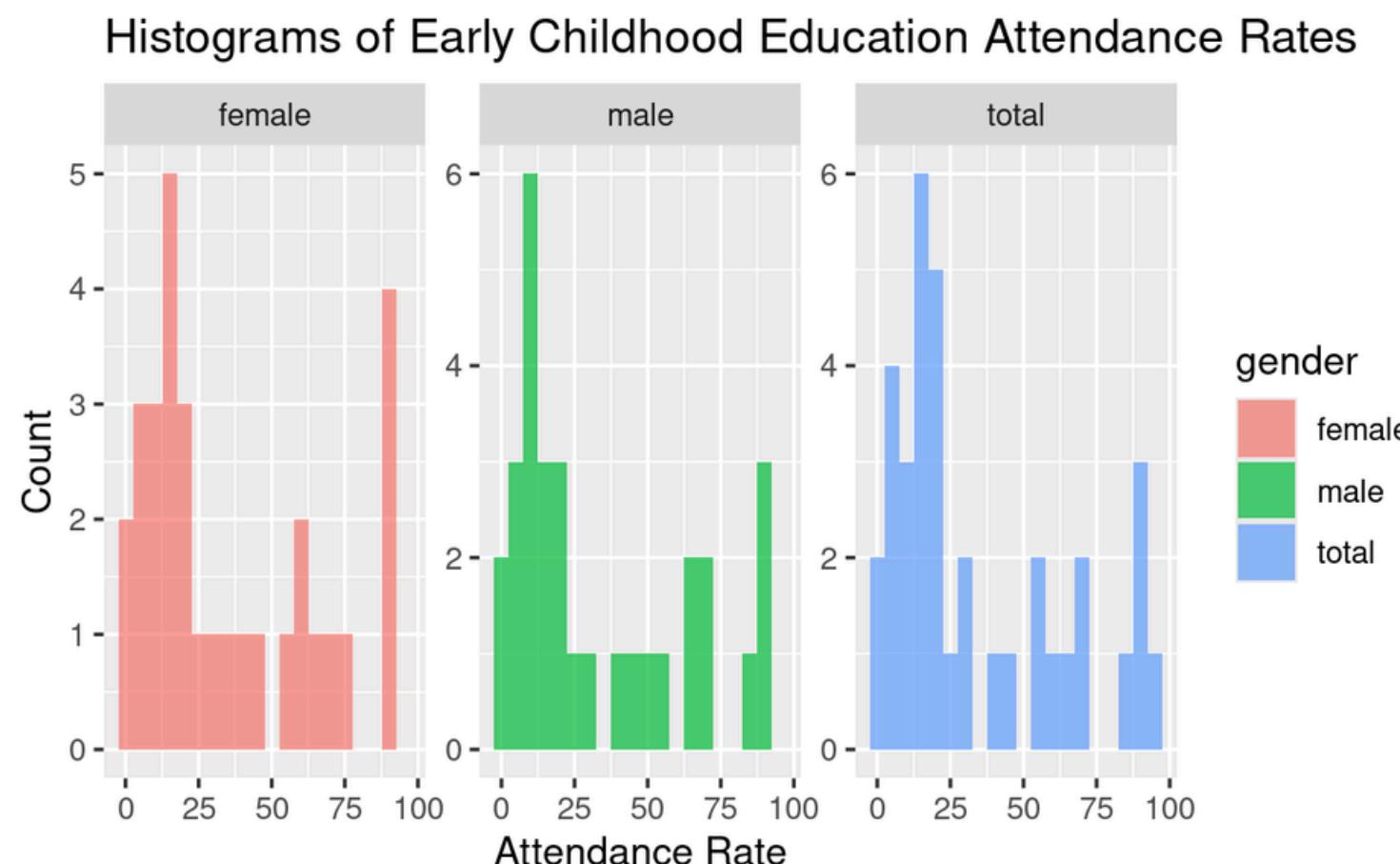
- hypothesis testing was used to compare if the attendance rate by gender is statistically significantly different.
- the data is from all countries in Africa so there is no concern about sampling methodology.

### Hypothesis

- our null hypotheses is that the rate of male and female attendance is the same while our alternative hypothesis is that they are different.
- we will test at .05 alpha level.

# Visualizations

## Histogram



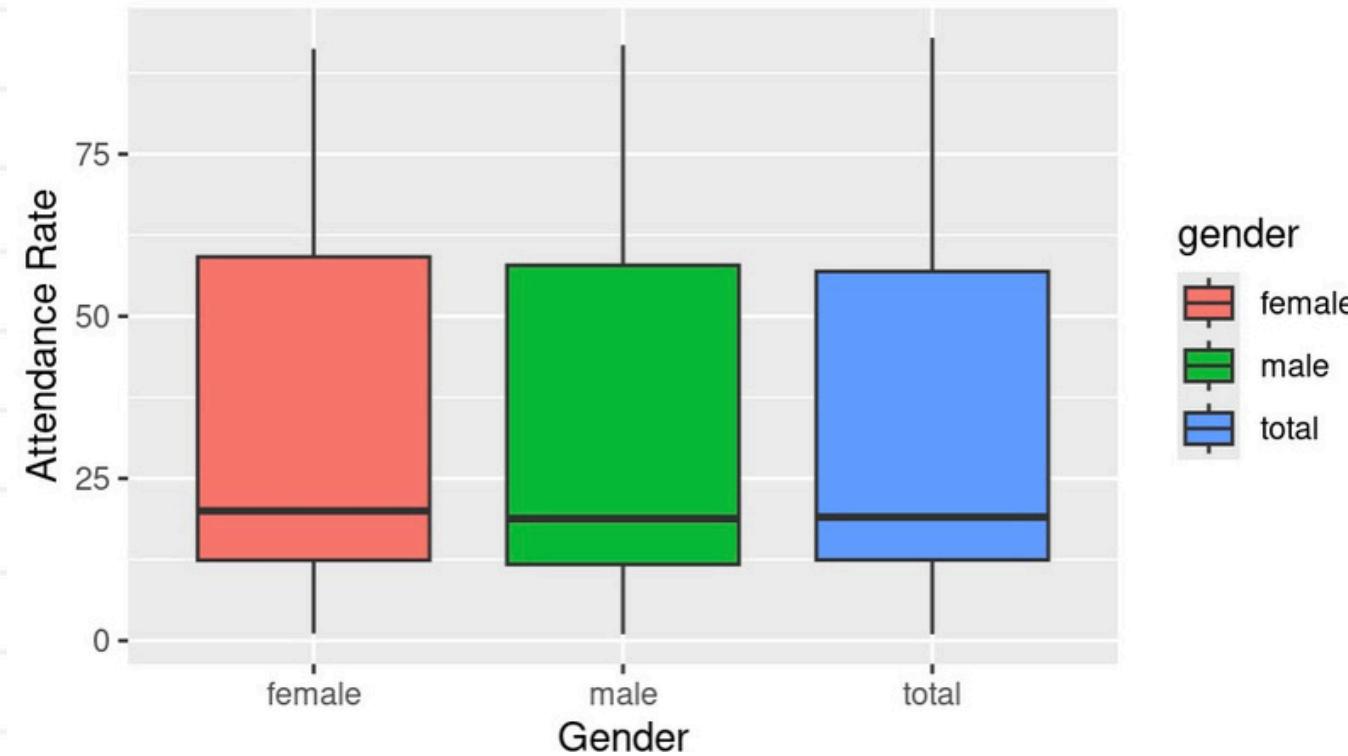
## Distribution Shape:

The histograms for 'female', 'male', and 'total' attendance rates appear to be **right-skewed**. This indicates a higher frequency of **lower attendance rates** and a tail that extends to the right, suggesting fewer countries with high attendance rates.

There appears to not be a large difference between female and male.

# Boxplot

Boxplot of Early Childhood Education Attendance Rates by



Median: of attendance about 25%

IQR: male more than female, so greater

variability in attendance rates for males and  
the combined total compared to females.

no substantial difference in central  
tendency between the two groups

# Hypothesis Test

## Welch Two Sample t-test

```
data: attendance_rate by gender
t = 0.19712, df = 59.999, p-value = 0.8444
alternative hypothesis: true difference in means between group female
and group male is not equal to 0
95 percent confidence interval:
-13.82817 16.85152
sample estimates:
mean in group female   mean in group male
35.72587               34.21419
```

**p-value = 0.8444**

We fail to reject the null and there  
is not a difference in attendance rate  
based on gender

## Research Question

03

**Among African countries, what's the relationship between quality education SDG progress and gender equality SDG progress?**

Quality education requires gender equity, so we thought that countries which had higher gender equality SDG scores would also have higher quality education SDG scores.

# Data used

03

From country\_codes.csv

## **region\_name**

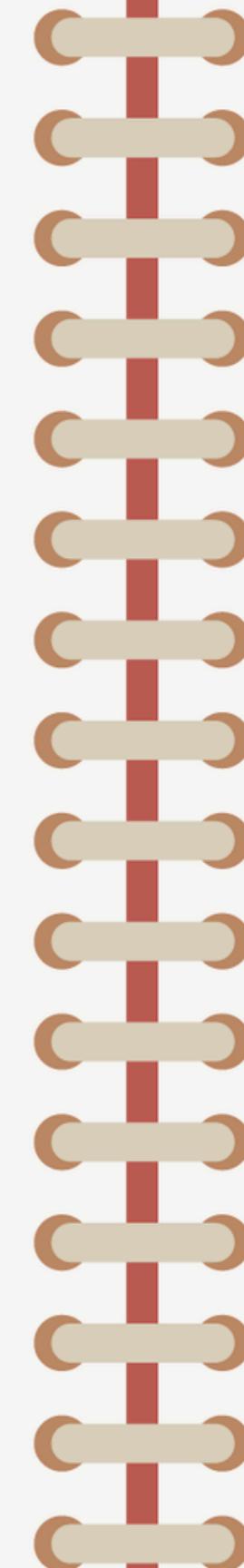
-lists continent country is  
in

## **Country\_name**

-lists the name of the country

## **Country\_label**

-lists the name of the country



from sdr\_fd5e4b5a.csv

## **SDG 5 score**

-measures gender equality  
-achievement of SDG 5  
goals

## **SDG 4 score**

-measures quality  
education  
-achievement of SDG 4  
goals

# Data Wrangling Method:

03

Select



Filter

Right\_join



Use the common column  
“country name” to integrate  
two data sets



Get 60 observations overall  
(60 African countries)

# Methodology:

## Linear Regression

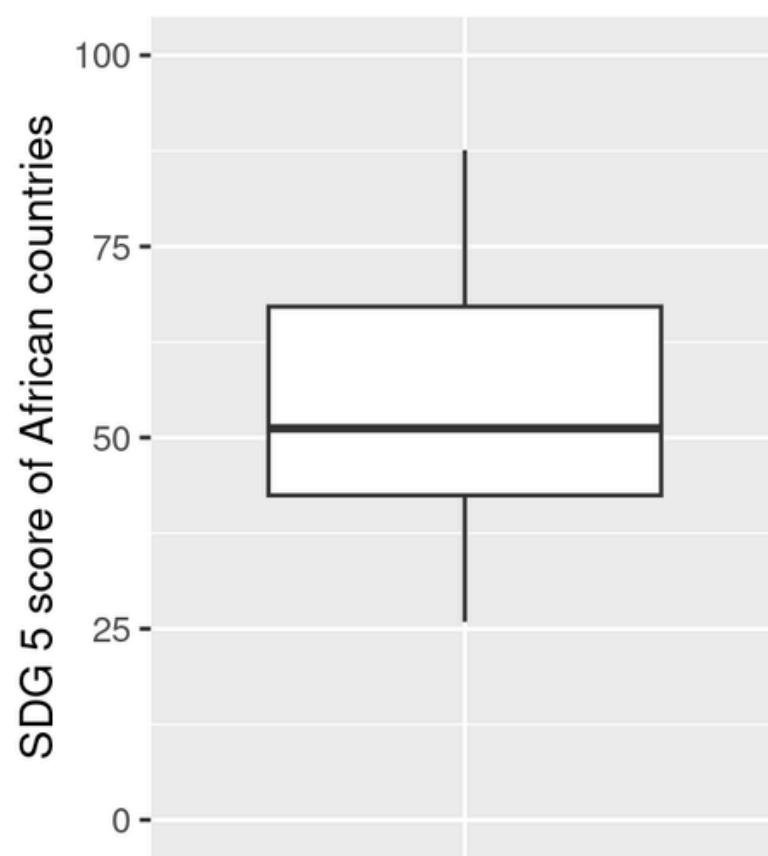
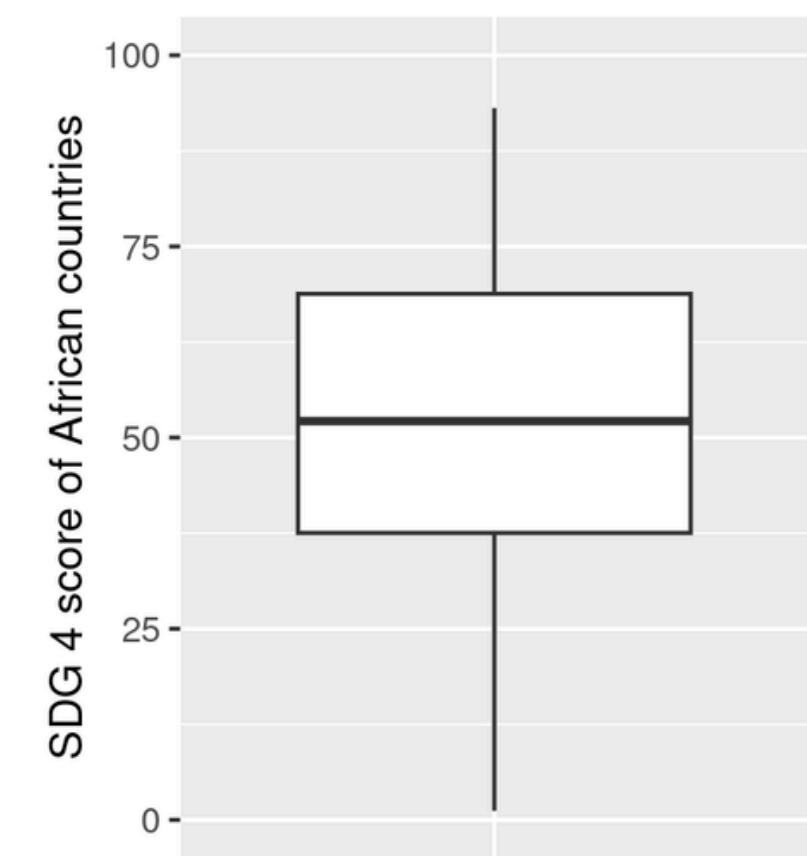
### Asumptions and Justications

- used linear regression to understand the correlation between SDG 5 and SDG 4
- we assume there is a linear relation between SDG 5 and 4 because this appears to be the case in the scatter plot
- we assume the data is normally distributed

# Visualizations

- There are more variations in SDG 4 scores. (Spread wider)
- Median same (Around 51)
- SDG4 score distribution: quite symmetric  
SDG5 score: right skewed

**Comparing SDG 4 and SDG 5 score**



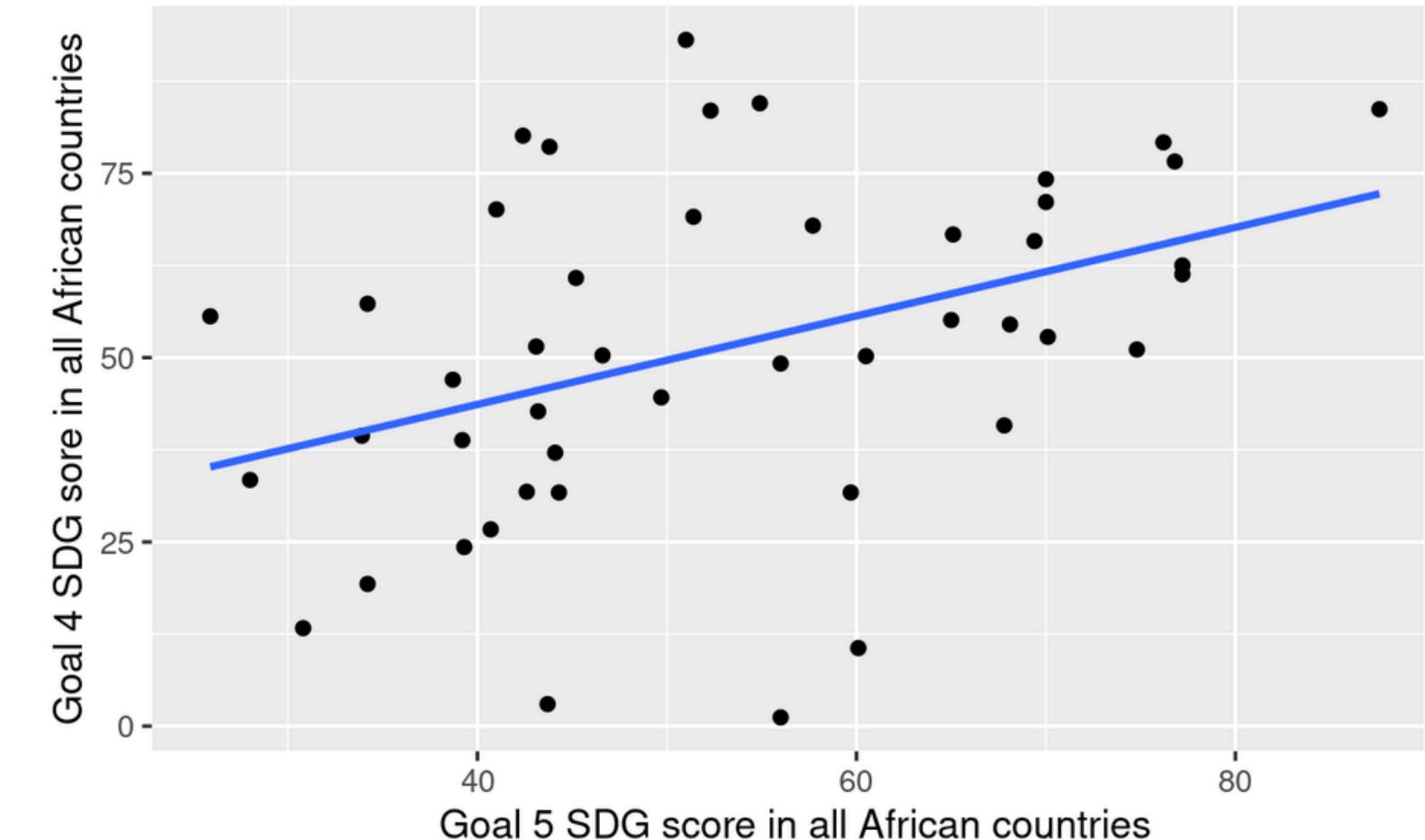
## Linear regression between SDG 4 and SDG 5

There appears to be a positive but weak correlation between SDG 5 and 4 because  $r$  is  $< .85$ .

So, countries with high SDG 5 scores will **maybe** have higher SDG 4 scores.

### Regression Statistics:

	Estimate	Std. Error	t value	Pr(> t )
(Intercept)	19.6342689	11.2267728	1.748879	0.08728561
Goal_5_score	0.6003771	0.2026965	2.961951	0.00491416



```
##r value
cor(x= data2$Goal_5_score, y= data2$Goal_4_score)
```

**$r = 0.4077287$**



# Main finding

## In Africa:

Countries with less gender inequality have higher quality education score

There is no difference in attendance for males and females for early childhood education

There is a weak correlation between Quality Education SDG and Gender Equality SDG

01

02

03

## Meaning

A focus on gender equality helps achieve quality education in Africa but more can be done to expand schooling.

# Limitations

It was not tested if the data is normally distributed.

This is beyond the skills of class.

There is an overlap in how GII and SDG 4 scores are calculated.

It is useful to consider the results from question one with grain of salt.

# Connecting Back to Central Question

Gender equality has a weak impact on quality education. Countries with higher GII scores had higher SDG 4 scores but when using a linear regression this correlation was weak. We noted there is a low attendance rate for early childhood education indicating that providing education to anyone is a challenge.

## Implications

Countries in Africa should focus on gender equity in education but also providing more educational services. Since, gender quality sometimes had an impact on SDG 4 but their is still a low attendance for early childhood education for all genders.

# Citations

Sustainable Development Solutions Network. (2023). Interactive Map. Sustainable Development Report.  
<https://dashboards.sdgindex.org/map>

United Nations Development Programme. (n.d.). Gender Inequality Index. Retrieved April 6, 2024, from <https://hdr.undp.org/data-center/thematic-composite-indices/gender-inequality-index#/indices/GII>

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