Education Statistics Dataset

by Pittawat Taveekitworachai 61130500220

Data Source: World Bank

Education is one of a very important aspects in governing the country. Education can pave a way for the future generation. Schooling period is a bubble zone for the youngest generation of the society to learn and try out many different things with minimal setback. Good education system will prepare the future generation for any circumstances. That's why education has been chosen in this analysis.

Thailand education system has many myths. In this analysis, we will see if it is true or not.

Setup

Import required dependencies

In [ ]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from matplotlib.dates import DateFormatter
import matplotlib.dates as mdates
```

General config

In [ ]:
```
sns.set_style("darkgrid")
```

In [ ]:
```
from google.colab import drive
drive.mount('/gdrive')
```

```
Mounted at /gdrive
```

In [ ]:
```
prefix_path = '/gdrive/MyDrive/Colab Notebooks/CSC536/'
```

Import dataset and Data Examination

In [ ]:
```
country = pd.read_csv(f'{prefix_path}country.csv')
education = pd.read_csv(f'{prefix_path}education.csv')
```

In [ ]:
```
country.head()
```

Out[ ]:

	Country Code	Short Name	Table Name	Long Name	2-alpha code	Currency Unit	Special Notes	Region	In
0	ABW	Aruba	Aruba	Aruba	AW	Aruban florin	SNA data for 2000-2011 are updated from offici...	Latin America & Caribbean	in non
1	AFG	Afghanistan	Afghanistan	Islamic State of Afghanistan	AF	Afghan afghani	Fiscal year end: March 20; reporting period fo...	South Asia	ir
2	AGO	Angola	Angola	People's Republic of Angola	AO	Angolan kwanza	April 2013 database update: Based on IMF data,...	Sub-Saharan Africa	r ir
3	ALB	Albania	Albania	Republic of Albania	AL	Albanian lek	NaN	Europe & Central Asia	r ir
4	AND	Andorra	Andorra	Principality of Andorra	AD	Euro	NaN	Europe & Central Asia	in non

In [ ]:

```
education.head()
```

Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	1970	1971	1972	197
0	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2	NaN	NaN	NaN	Na
1	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2.F	NaN	NaN	NaN	Na
2	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2.GPI	NaN	NaN	NaN	Na
3	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2.M	NaN	NaN	NaN	Na
4	Arab World	ARB	Adjusted net enrolment rate, primary, both sex...	SE.PRM.TENR	54.822121	54.894138	56.209438	57.26710

In [ ]:

```
country.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 241 entries, 0 to 240
Data columns (total 32 columns):
 #   Column                                      Non-Null Count  Dty
pe
---  ------                                      --------------  ---
--
 0   Country Code                                241 non-null    obj
ect
 1   Short Name                                  241 non-null    obj
ect
 2   Table Name                                  241 non-null    obj
ect
 3   Long Name                                   241 non-null    obj
ect
 4   2-alpha code                                238 non-null    obj
ect
 5   Currency Unit                               215 non-null    obj
ect
 6   Special Notes                               145 non-null    obj
ect
 7   Region                                      214 non-null    obj
ect
```

```
 8   Income Group                                       214 non-null    obj
ect
 9   WB-2 code                                          240 non-null    obj
ect
 10  National accounts base year                        205 non-null    obj
ect
 11  National accounts reference year                   32 non-null     flo
at64
 12  SNA price valuation                                197 non-null    obj
ect
 13  Lending category                                   144 non-null    obj
ect
 14  Other groups                                       58 non-null     obj
ect
 15  System of National Accounts                        215 non-null    obj
ect
 16  Alternative conversion factor                      47 non-null     obj
ect
 17  PPP survey year                                    145 non-null    obj
ect
 18  Balance of Payments Manual in use                  181 non-null    obj
ect
 19  External debt Reporting status                     124 non-null    obj
ect
 20  System of trade                                    200 non-null    obj
ect
 21  Government Accounting concept                      161 non-null    obj
ect
 22  IMF data dissemination standard                    181 non-null    obj
ect
 23  Latest population census                           213 non-null    obj
ect
 24  Latest household survey                            141 non-null    obj
ect
 25  Source of most recent Income and expenditure data  160 non-null    obj
ect
 26  Vital registration complete                        111 non-null    obj
ect
 27  Latest agricultural census                         142 non-null    obj
ect
 28  Latest industrial data                             107 non-null    flo
at64
 29  Latest trade data                                  185 non-null    flo
at64
 30  Latest water withdrawal data                       179 non-null    obj
ect
 31  Unnamed: 31                                        0 non-null      flo
at64
dtypes: float64(4), object(28)
memory usage: 60.4+ KB
```

In [ ]:

```
education.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 886930 entries, 0 to 886929
Data columns (total 70 columns):
 #   Column          Non-Null Count   Dtype
---  ------          --------------   -----
 0   Country Name    886930 non-null  object
 1   Country Code    886930 non-null  object
 2   Indicator Name  886930 non-null  object
 3   Indicator Code  886930 non-null  object
 4   1970            72288 non-null   float64
 5   1971            35537 non-null   float64
```

```
 6   1972            35619 non-null   float64
 7   1973            35545 non-null   float64
 8   1974            35730 non-null   float64
 9   1975            87306 non-null   float64
 10  1976            37483 non-null   float64
 11  1977            37574 non-null   float64
 12  1978            37576 non-null   float64
 13  1979            36809 non-null   float64
 14  1980            89122 non-null   float64
 15  1981            38777 non-null   float64
 16  1982            37511 non-null   float64
 17  1983            38460 non-null   float64
 18  1984            38606 non-null   float64
 19  1985            90296 non-null   float64
 20  1986            39372 non-null   float64
 21  1987            38641 non-null   float64
 22  1988            38552 non-null   float64
 23  1989            37540 non-null   float64
 24  1990            124405 non-null  float64
 25  1991            74437 non-null   float64
 26  1992            75543 non-null   float64
 27  1993            75793 non-null   float64
 28  1994            77462 non-null   float64
 29  1995            131361 non-null  float64
 30  1996            76807 non-null   float64
 31  1997            73453 non-null   float64
 32  1998            84914 non-null   float64
 33  1999            118839 non-null  float64
 34  2000            176676 non-null  float64
 35  2001            123509 non-null  float64
 36  2002            124205 non-null  float64
 37  2003            130363 non-null  float64
 38  2004            128814 non-null  float64
 39  2005            184108 non-null  float64
 40  2006            140312 non-null  float64
 41  2007            137272 non-null  float64
 42  2008            134387 non-null  float64
 43  2009            142108 non-null  float64
 44  2010            242442 non-null  float64
 45  2011            146012 non-null  float64
 46  2012            147264 non-null  float64
 47  2013            137509 non-null  float64
 48  2014            113789 non-null  float64
 49  2015            131058 non-null  float64
 50  2016            16460 non-null   float64
 51  2017            143 non-null     float64
 52  2020            51436 non-null   float64
 53  2025            51436 non-null   float64
 54  2030            51436 non-null   float64
 55  2035            51436 non-null   float64
 56  2040            51436 non-null   float64
 57  2045            51436 non-null   float64
 58  2050            51436 non-null   float64
 59  2055            51436 non-null   float64
 60  2060            51436 non-null   float64
 61  2065            51436 non-null   float64
 62  2070            51436 non-null   float64
 63  2075            51436 non-null   float64
 64  2080            51436 non-null   float64
 65  2085            51436 non-null   float64
 66  2090            51436 non-null   float64
 67  2095            51436 non-null   float64
 68  2100            51436 non-null   float64
 69  Unnamed: 69     0 non-null       float64
dtypes: float64(66), object(4)
```

```
memory usage: 473.7+ MB
```

In [ ]:
```
country.describe()
```

Out[ ]:

	National accounts reference year	Latest industrial data	Latest trade data	Unnamed: 31
count	32.00000	107.000000	185.000000	0.0
mean	2001.53125	2008.102804	2010.994595	NaN
std	5.24856	2.616834	2.569675	NaN
min	1987.00000	2000.000000	1995.000000	NaN
25%	1996.75000	2007.500000	2011.000000	NaN
50%	2002.00000	2009.000000	2012.000000	NaN
75%	2005.00000	2010.000000	2012.000000	NaN
max	2012.00000	2010.000000	2012.000000	NaN

In [ ]:
```
education.describe()
```

Out[ ]:

	1970	1971	1972	1973	1974	
count	7.228800e+04	3.553700e+04	3.561900e+04	3.554500e+04	3.573000e+04	8.73(
mean	1.974772e+09	4.253638e+09	4.592365e+09	5.105006e+09	5.401493e+09	2.31⁴
std	1.211687e+11	1.804814e+11	1.914083e+11	2.059170e+11	2.112150e+11	1.37
min	-1.435564e+00	-1.594625e+00	-3.056522e+00	-4.032582e+00	-4.213563e+00	-3.65
25%	8.900000e-01	8.853210e+00	9.240920e+00	9.595200e+00	9.861595e+00	1.40(
50%	6.317724e+00	6.316240e+01	6.655139e+01	6.969595e+01	7.087760e+01	9.67
75%	6.251250e+01	5.655200e+04	5.863650e+04	6.202900e+04	6.383675e+04	7.85
max	1.903929e+13	1.986457e+13	2.100916e+13	2.238367e+13	2.282991e+13	2.30

In [ ]:
```
country.isnull().sum()
```

Out[ ]:
```
Country Code                                                  0
Short Name                                                    0
Table Name                                                    0
Long Name                                                     0
2-alpha code                                                  3
Currency Unit                                                26
Special Notes                                                96
Region                                                       27
Income Group                                                 27
WB-2 code                                                     1
National accounts base year                                  36
National accounts reference year                            209
SNA price valuation                                          44
Lending category                                             97
Other groups                                                183
System of National Accounts                                  26
Alternative conversion factor                               194
PPP survey year                                              96
Balance of Payments Manual in use                            60
External debt Reporting status                              117
System of trade                                              41
Government Accounting concept                                80
IMF data dissemination standard                              60
Latest population census                                     28
Latest household survey                                     100
Source of most recent Income and expenditure data            81
Vital registration complete                                 130
Latest agricultural census                                   99
Latest industrial data                                      134
Latest trade data                                            56
Latest water withdrawal data                                 62
Unnamed: 31                                                 241
dtype: int64
```

In [ ]:
```
education.isnull().sum()
```

Out[ ]:
```
Country Name           0
Country Code           0
Indicator Name         0
Indicator Code         0
1970              814642
                    ...
2085              835494
2090              835494
2095              835494
2100              835494
Unnamed: 69       886930
Length: 70, dtype: int64
```

Data Preparation

In [ ]:
```
country['Unnamed: 31'].unique()
```

Out[ ]:
```
array([nan])
```

In [ ]:
```
education['Unnamed: 69'].unique()
```

Out[ ]:
```
array([nan])
```

In [ ]:
```
country.drop('Unnamed: 31', axis='columns', inplace=True)
education.drop('Unnamed: 69', axis='columns', inplace=True)
```

In [ ]:
```
education = education.melt(id_vars=['Country Name', 'Country Code', 'Indica
        var_name='Year',
        value_name='Value')
```

In [ ]:
```
education.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 57650450 entries, 0 to 57650449
Data columns (total 6 columns):
 #   Column          Dtype  
---  ------          -----  
 0   Country Name    object 
 1   Country Code    object 
 2   Indicator Name  object 
 3   Indicator Code  object 
 4   Year            object 
 5   Value           float64
dtypes: float64(1), object(5)
memory usage: 2.6+ GB
```

In [ ]:
```
education.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 57650450 entries, 0 to 57650449
Data columns (total 6 columns):
 #   Column          Dtype  
---  ------          -----  
 0   Country Name    object 
 1   Country Code    object 
 2   Indicator Name  object 
 3   Indicator Code  object 
 4   Year            object 
 5   Value           float64
dtypes: float64(1), object(5)
memory usage: 2.6+ GB
```

In [ ]:
```
education['Year'] = pd.to_datetime(education['Year'], format='%Y')
```

In [ ]:
```
education.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 57650450 entries, 0 to 57650449
Data columns (total 6 columns):
 #   Column          Dtype
---  ------          -----
 0   Country Name    object
 1   Country Code    object
 2   Indicator Name  object
 3   Indicator Code  object
 4   Year            datetime64[ns]
 5   Value           float64
dtypes: datetime64[ns](1), float64(1), object(4)
memory usage: 2.6+ GB
```

In [ ]:
```
education.head()
```

Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
0	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2	1970-01-01	NaN
1	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2.F	1970-01-01	NaN
2	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2.GPI	1970-01-01	NaN
3	Arab World	ARB	Adjusted net enrolment rate, lower secondary, ...	UIS.NERA.2.M	1970-01-01	NaN
4	Arab World	ARB	Adjusted net enrolment rate, primary, both sex...	SE.PRM.TENR	1970-01-01	54.822121

In [ ]:
```
education = education.dropna()
```

In [ ]:
```
education['Indicator Name'].unique()
```

Out[ ]:
```
array(['Adjusted net enrolment rate, primary, both sexes (%)',
       'Adjusted net enrolment rate, primary, female (%)',
       'Adjusted net enrolment rate, primary, gender parity index (GPI)',
       ...,
       'SABER: (Tertiary Education) Policy Goal 6 Lever 2: Fostering RDI an
d Innovation',
       'SABER: (Tertiary Education) Policy Goal 6 Lever 3: Fostering Social
and Cultural Development and Environmental Protection and Sustainability',
       'SABER: (Tertiary Education) Policy Goal 6: The Relevance of Tertiar
y Education for Economic and Social Needs'],
      dtype=object)
```

Data Visualization

GDP per capita, PPP (current international $) Thailand vs World

In [ ]:
```
gdp = education[(education['Indicator Name'] == 'GDP per capita, PPP (curre
```

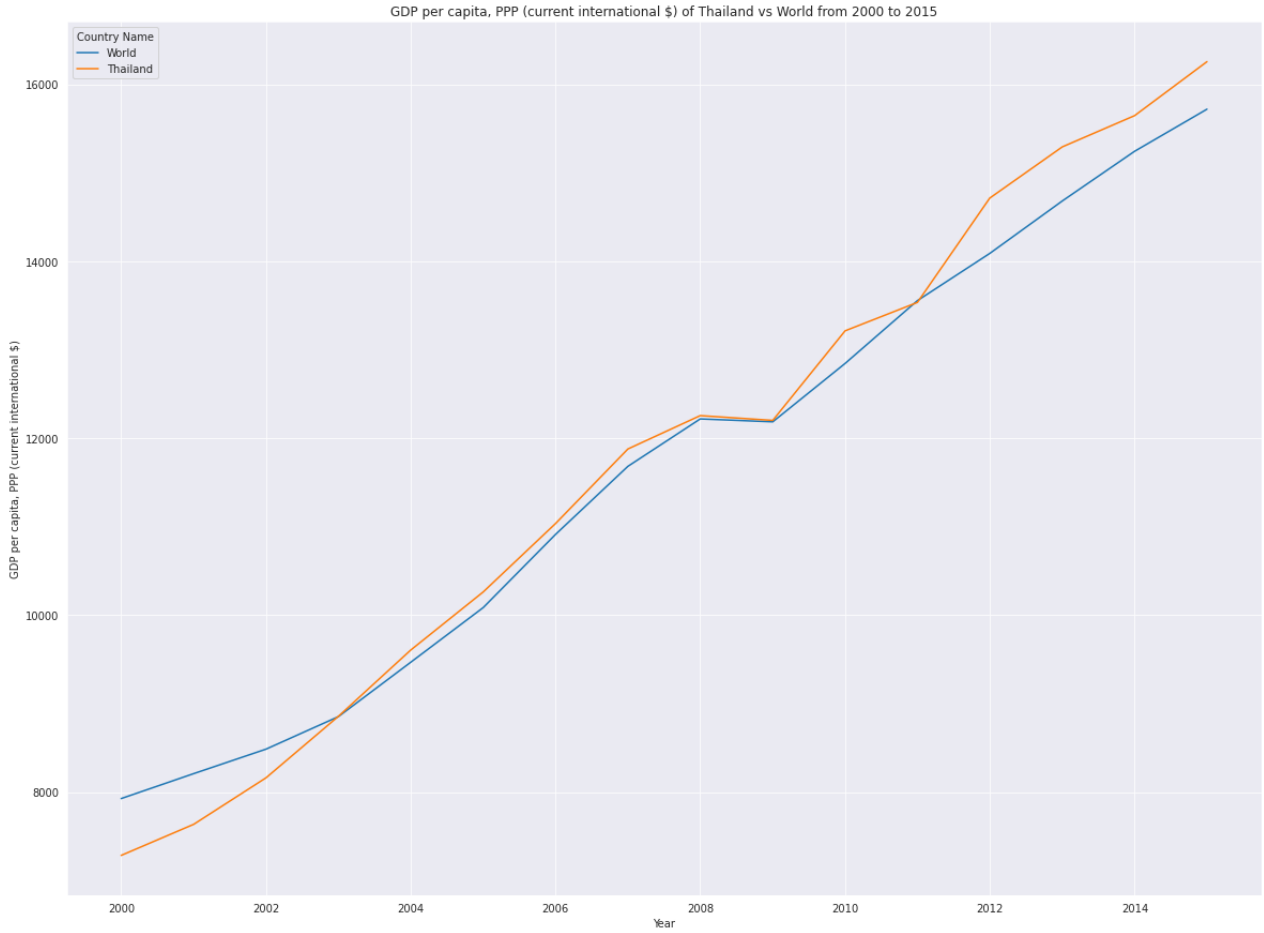
In [ ]:
```
gdp_th_world = gdp[(gdp['Country Name'] == 'Thailand') | (gdp['Country Name
gdp_th_world.head()
```

Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
26697107	World	WLD	GDP per capita, PPP (current international $)	NY.GDP.PCAP.PP.CD	2000-01-01	7926.047904
27404452	Thailand	THA	GDP per capita, PPP (current international $)	NY.GDP.PCAP.PP.CD	2000-01-01	7283.511290
27584037	World	WLD	GDP per capita, PPP (current international $)	NY.GDP.PCAP.PP.CD	2001-01-01	8208.189373
28291382	Thailand	THA	GDP per capita, PPP (current international $)	NY.GDP.PCAP.PP.CD	2001-01-01	7635.093003
28470967	World	WLD	GDP per capita, PPP (current international $)	NY.GDP.PCAP.PP.CD	2002-01-01	8484.916473

In [ ]:
```
plt.figure(figsize=(20,15))

ax = sns.lineplot(data=gdp_th_world, x="Year", y="Value", hue='Country Name

ax.set_title("GDP per capita, PPP (current international $) of Thailand vs
ax.set_xlabel('Year')
ax.set_ylabel('GDP per capita, PPP (current international $)')
```

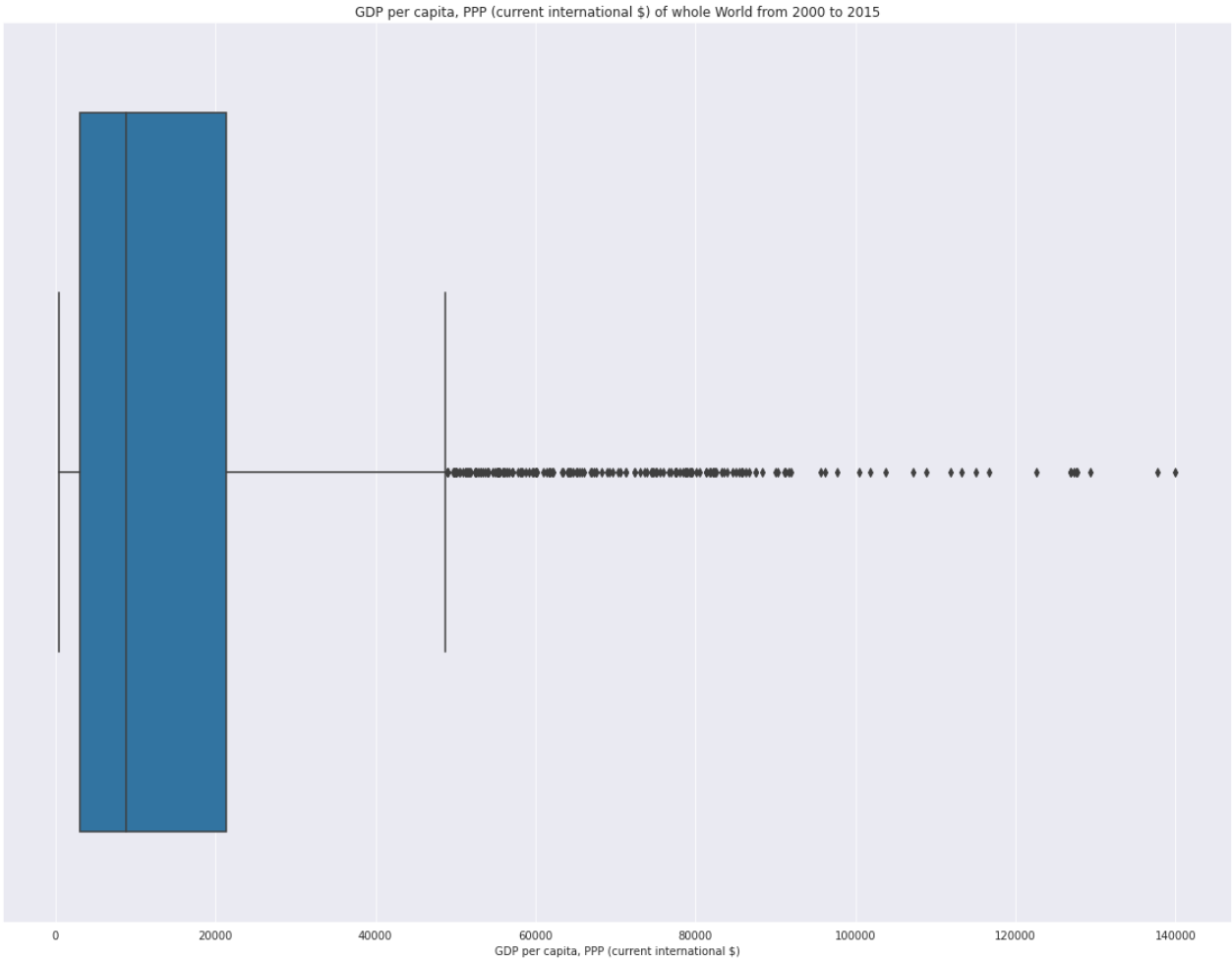
Out[ ]: Text(0, 0.5, 'GDP per capita, PPP (current international $)')



In this time-series plot, it shows that gross domestic product scaled with purchasing power parity and current international dollars. It means the GDP is scaled to the current value of dollars unit and apply the scaling on the price of common goods to have the same scale for comparison. It can be seen that comparing Thailand to the average of the world, Thailand is doing quite good. Because the GDP (PPP) of Thailand over time is around the average from 2000 to 2015. GDP is one of a very good indicator on how each country doing in term of economic. As generally know that economic status can affect other aspects of the country, for example, education, politics, health services.

In [ ]:
```
plt.figure(figsize=(20,15))

ax = sns.boxplot(x="Value", data=gdp)

ax.set_title("GDP per capita, PPP (current international $) of whole World
ax.set_xlabel('GDP per capita, PPP (current international $)')
```

Out[ ]: Text(0.5, 0, 'GDP per capita, PPP (current international $)')



Observing the boxplot and it can be seen that most country fall below the average, so Thailand doing around average is quite good to be said. But the maximum and minimum also very wide. So, some countries has very high and extremely low GDP.

PISA Thailand vs World

In [ ]:
```
pisa_math = education[education['Indicator Name'] == 'PISA: Mean performanc
pisa_read = education[education['Indicator Name'] == 'PISA: Mean performanc
pisa_sci = education[education['Indicator Name'] == 'PISA: Mean performance
```

In [ ]:
```
pisa_math_th = pisa_math[pisa_math['Country Name'] == 'Thailand']
pisa_read_th = pisa_read[pisa_read['Country Name'] == 'Thailand']
pisa_sci_th = pisa_sci[pisa_sci['Country Name'] == 'Thailand']
```

In [ ]:
```
pisa_math_mean_world = pisa_math.groupby('Year', as_index=False).mean()
pisa_math_mean_world['Country Name'] = 'World'
pisa_math_mean_world['Country Code'] = 'WRD'
pisa_math_mean_world['Indicator Name'] = 'PISA: Mean performance on the mat
pisa_math_mean_world['Indicator Code'] = 'LO.PISA.MAT'
pisa_math_mean_world.head()
```

Out[ ]:

	Year	Value	Country Name	Country Code	Indicator Name	Indicator Code
0	2000-01-01	470.226190	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT
1	2003-01-01	485.760587	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT
2	2006-01-01	467.643993	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT
3	2009-01-01	461.926995	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT
4	2012-01-01	473.109462	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT

In [ ]:

```
pisa_read_mean_world = pisa_read.groupby('Year', as_index=False).mean()
pisa_read_mean_world['Country Name'] = 'World'
pisa_read_mean_world['Country Code'] = 'WRD'
pisa_read_mean_world['Indicator Name'] = 'PISA: Mean performance on the rea
pisa_read_mean_world['Indicator Code'] = 'LO.PISA.REA'
pisa_read_mean_world.head()
```

Out[ ]:

	Year	Value	Country Name	Country Code	Indicator Name	Indicator Code
0	2000-01-01	471.349832	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA
1	2003-01-01	480.876088	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA
2	2006-01-01	458.893651	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA
3	2009-01-01	458.963963	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA
4	2012-01-01	473.204464	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA

In [ ]:

```
pisa_sci_mean_world = pisa_sci.groupby('Year', as_index=False).mean()
pisa_sci_mean_world['Country Name'] = 'World'
pisa_sci_mean_world['Country Code'] = 'WRD'
pisa_sci_mean_world['Indicator Name'] = 'PISA: Mean performance on the sci
pisa_sci_mean_world['Indicator Code'] = 'LO.PISA.SCI'
pisa_sci_mean_world.head()
```

Out[ ]:

	Year	Value	Country Name	Country Code	Indicator Name	Indicator Code
0	2000-01-01	473.170070	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI
1	2003-01-01	488.519952	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI
2	2006-01-01	472.159265	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI
3	2009-01-01	466.125810	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI
4	2012-01-01	477.916935	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI

In [ ]:

```
pisa_th_world = pd.concat([pisa_math_th, pisa_math_mean_world, pisa_read_tl
pisa_th_world
```

Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
27405503	Thailand	THA	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2000-01-01	432.000000
30066293	Thailand	THA	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2003-01-01	416.977960
32727083	Thailand	THA	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2006-01-01	417.072614
35387873	Thailand	THA	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2009-01-01	418.583935
38048663	Thailand	THA	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2012-01-01	426.737491
40709453	Thailand	THA	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2015-01-01	415.463800
0	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2000-01-01	470.226190
1	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2003-01-01	485.760587
2	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2006-01-01	467.643993
3	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2009-01-01	461.926995
			PISA: Mean performance			

4	World	WRD	on the mathematics scale	LO.PISA.MAT	2012-01-01	473.109462
5	World	WRD	PISA: Mean performance on the mathematics scale	LO.PISA.MAT	2015-01-01	459.571028
27405506	Thailand	THA	PISA: Mean performance on the reading scale	LO.PISA.REA	2000-01-01	430.683873
30066296	Thailand	THA	PISA: Mean performance on the reading scale	LO.PISA.REA	2003-01-01	419.914829
32727086	Thailand	THA	PISA: Mean performance on the reading scale	LO.PISA.REA	2006-01-01	416.751765
35387876	Thailand	THA	PISA: Mean performance on the reading scale	LO.PISA.REA	2009-01-01	421.374414
38048666	Thailand	THA	PISA: Mean performance on the reading scale	LO.PISA.REA	2012-01-01	441.219934
40709456	Thailand	THA	PISA: Mean performance on the reading scale	LO.PISA.REA	2015-01-01	409.130100
0	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA	2000-01-01	471.349832
1	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA	2003-01-01	480.876088
2	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA	2006-01-01	458.893651
3	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA	2009-01-01	458.963963
4	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA	2012-01-01	473.204464
5	World	WRD	PISA: Mean performance on the reading scale	LO.PISA.REA	2015-01-01	459.393469
27405509	Thailand	THA	PISA: Mean performance on the science scale	LO.PISA.SCI	2000-01-01	436.378537
30066299	Thailand	THA	PISA: Mean performance on the science scale	LO.PISA.SCI	2003-01-01	429.060378
32727089	Thailand	THA	PISA: Mean performance on the science scale	LO.PISA.SCI	2006-01-01	421.011469
35387879	Thailand	THA	PISA: Mean performance on the science scale	LO.PISA.SCI	2009-01-01	425.296285
38048669	Thailand	THA	PISA: Mean performance on the science scale	LO.PISA.SCI	2012-01-01	443.999935
40709459	Thailand	THA	PISA: Mean performance on the science scale	LO.PISA.SCI	2015-01-01	421.337300
0	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI	2000-01-01	473.170070
1	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI	2003-01-01	488.519952
2	World	WRD	PISA: Mean performance	LO.PISA.SCI	2006-	472.159265

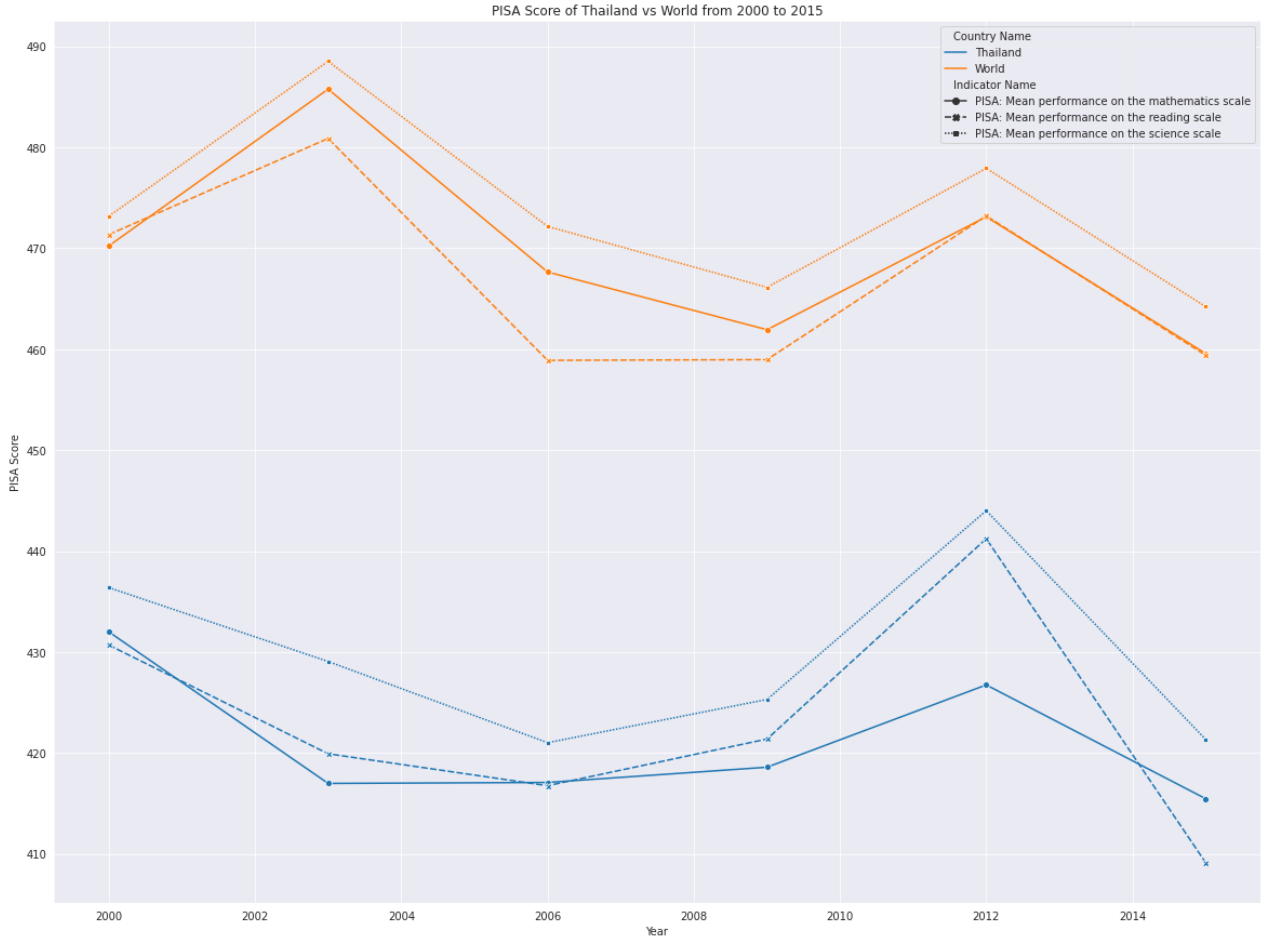
			on the science scale		01-01	
3	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI	2009-01-01	466.125810
4	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI	2012-01-01	477.916935
5	World	WRD	PISA: Mean performance on the science scale	LO.PISA.SCI	2015-01-01	464.213785

In [ ]:

```
plt.figure(figsize=(20,15))

ax = sns.lineplot(data=pisa_th_world, x="Year", y="Value", hue='Country Nar

ax.set_title("PISA Score of Thailand vs World from 2000 to 2015")
ax.set_xlabel('Year')
ax.set_ylabel('PISA Score')
```

Out[ ]:

```
Text(0, 0.5, 'PISA Score')
```



The Programme for International Student Assessment (PISA) is a worldwide study by the Organisation for Economic Co-operation and Development (OECD) in member and non-member nations intended to evaluate educational systems by measuring 15-year-old school pupils' scholastic performance on mathematics, science, and reading. PISA is held every three years. This graph stated all three types of PISA test's scores, mathematics, reading, and science. This chart comapres the score between Thailand and the average score on the world. The PISA score scaled to fit normal distribution, so maximum and minimum score does not really matter much. In this comparison, Thailand performs poorly compare to the world average. Despite the fact that Thailand performs quite well on the GDP that comparable to the average.

Average Years of Primary Schooling of Thailand vs World

In [ ]:
```
primary_schooling = education[education['Indicator Name'] == 'Barro-Lee: Av
```

In [ ]:
```
primary_schooling_world = primary_schooling.groupby('Year', as_index=False
primary_schooling_world['Country Name'] = 'World'
primary_schooling_world['Country Code'] = 'WTD'
primary_schooling_world['Indicator Name'] = 'Barro-Lee: Average years of pr
primary_schooling_world['Indicator Code'] = 'BAR.PRM.SCHL.15UP'
primary_schooling_world.head()
```

Out[ ]:

	Year	Value	Country Name	Country Code	Indicator Name	Indicator Code
0	1970-01-01	3.101944	World	WTD	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP
1	1975-01-01	3.357847	World	WTD	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP
2	1980-01-01	3.633611	World	WTD	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP
3	1985-01-01	3.890208	World	WTD	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP
4	1990-01-01	4.102153	World	WTD	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP

In [ ]:
```
primary_schooling_th = primary_schooling[primary_schooling['Country Name']
primary_schooling_th.head()
```

Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
795455	Thailand	THA	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP	1970-01-01	2.15
5230105	Thailand	THA	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP	1975-01-01	2.46
9664755	Thailand	THA	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP	1980-01-01	2.87
14099405	Thailand	THA	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP	1985-01-01	3.24
18534055	Thailand	THA	Barro-Lee: Average years of primary schooling,...	BAR.PRM.SCHL.15UP	1990-01-01	3.75

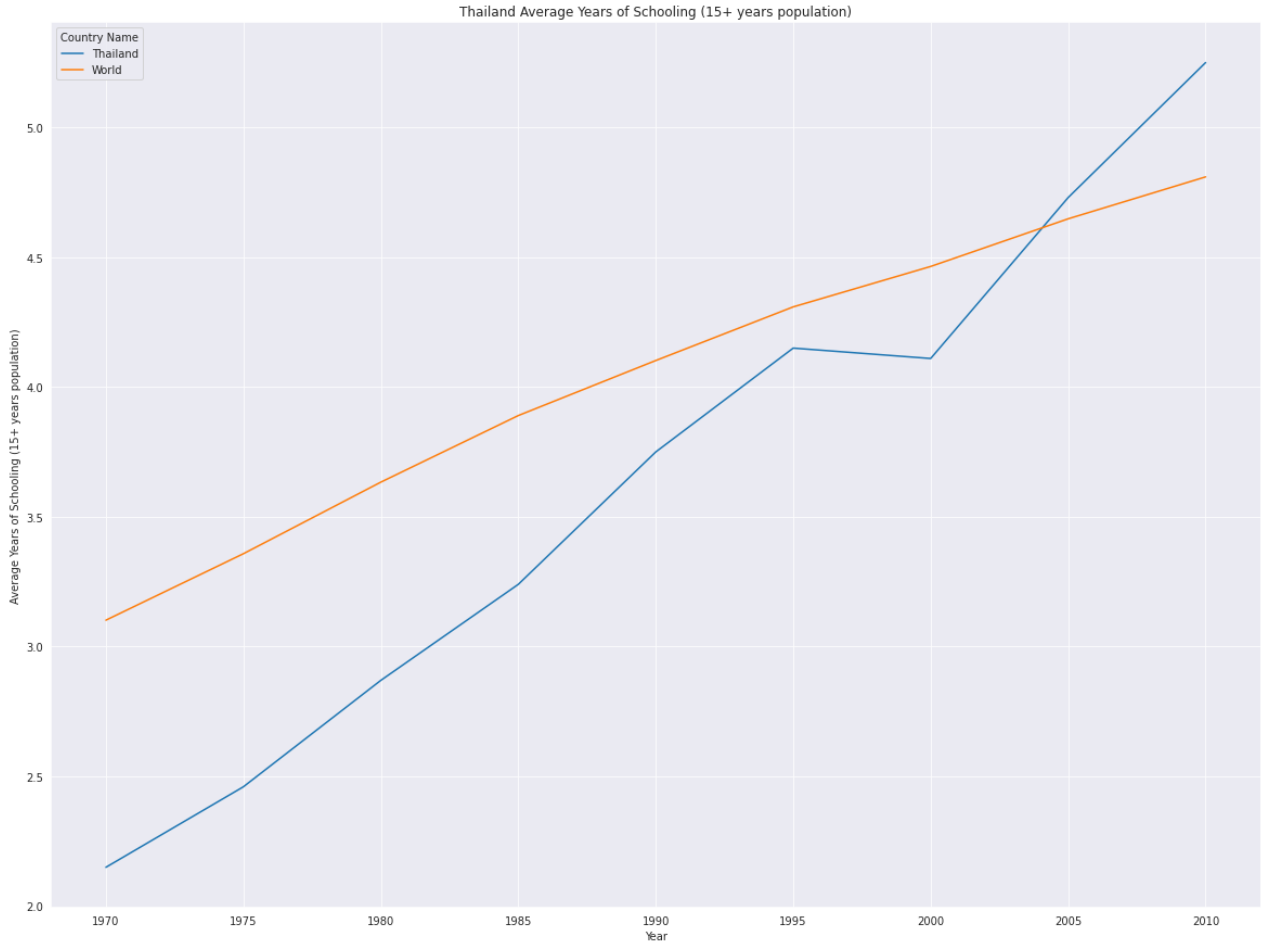
In [ ]:

```
primary_schooling_th_world = pd.concat([primary_schooling_th, primary_schoo
```

In [ ]:

```
plt.figure(figsize=(20,15))

ax = sns.lineplot(data=primary_schooling_th_world, x="Year", y="Value", hue

ax.set_title("Thailand Average Years of Schooling (15+ years population)")
ax.set_xlabel('Year')
ax.set_ylabel('Average Years of Schooling (15+ years population)')
```

Out[ ]: Text(0, 0.5, 'Average Years of Schooling (15+ years population)')

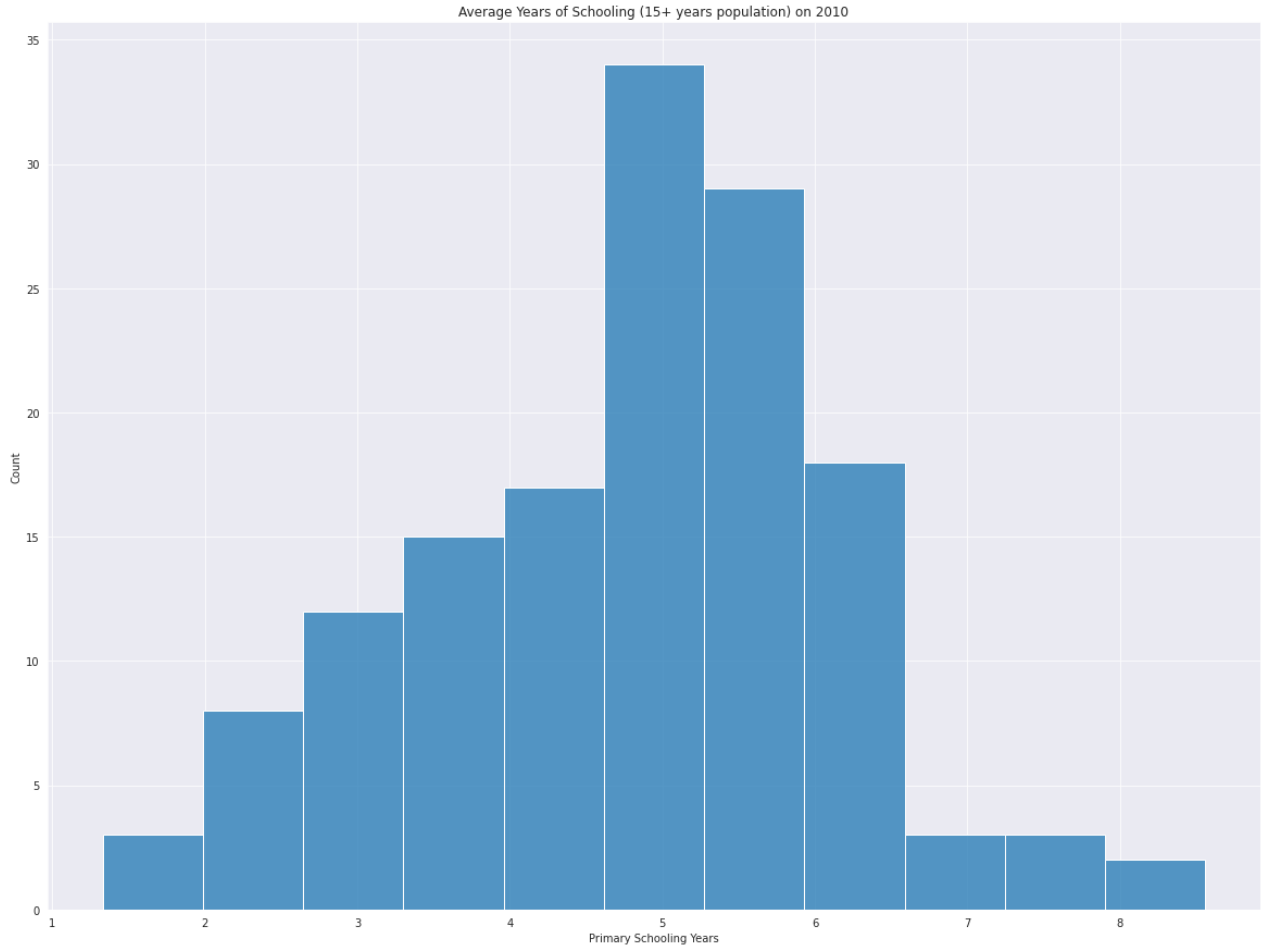


This chart shows the average years of schooling of population with age over 15 in Thailand compare to the world average. It can be clearly seen that Thailand's primary schooling years is longer than the average of the world. So, we can roughly say that with longer priamry education time, population maybe better at basic skills such as mathematics and reading. But the trend of Thailand years is not that steep compare to the world average. So, the world puts more effort to accelerate the rate of change in primary schooling years.

In [ ]:
```
primary_schooling_2010 = primary_schooling[primary_schooling['Year'] == '2(
```

In [ ]:
```
plt.figure(figsize=(20,15))

ax = sns.histplot(primary_schooling_2010, x="Value")

ax.set_title("Average Years of Schooling (15+ years population) on 2010")
ax.set_xlabel('Primary Schooling Years')
ax.set_ylabel('Count')
```

Out[ ]: Text(0, 0.5, 'Count')



This histogram shows that most of the countries population has around 5 to 6 years (Thailand has around this number). This may not be surprising, since primary education usually take around 6 years for most of the countries. However, compare the left side and right side of the mean. It can be seen that most of the countries have less than 5 years of primary schooling.

TIMSS of Thailand vs World

In [ ]:
```
timss_math_four = education[education['Indicator Name'] == 'TIMSS: Mean pe
timss_math_eight = education[education['Indicator Name'] == 'TIMSS: Mean p
timss_sci_four = education[education['Indicator Name'] == 'TIMSS: Mean per
timss_sci_eight = education[education['Indicator Name'] == 'TIMSS: Mean pe
```

In [ ]:
```
timss_math_four_th = timss_math_four[timss_math_four['Country Name'] == 'Th
timss_math_eight_th = timss_math_eight[timss_math_eight['Country Name'] ==
timss_sci_four_th = timss_sci_four[timss_sci_four['Country Name'] == 'Thail
timss_sci_eight_th = timss_sci_eight[timss_sci_eight['Country Name'] == 'Th
```

In [ ]:
```
timss_math_four_world = timss_math_four.groupby('Year', as_index=False).mea
timss_math_four_world['Country Name'] = 'World'
timss_math_four_world['Country Code'] = 'WRD'
timss_math_four_world['Indicator Name'] = 'TIMSS: Mean performance on the m
timss_math_four_world['Indicator Code'] = 'LO.TIMSS.MAT4'
```

In [ ]:
```
timss_math_eight_world = timss_math_eight.groupby('Year', as_index=False).r
timss_math_eight_world['Country Name'] = 'World'
timss_math_eight_world['Country Code'] = 'WRD'
timss_math_eight_world['Indicator Name'] = 'TIMSS: Mean performance on the
timss_math_eight_world['Indicator Code'] = 'LO.TIMSS.MAT8'
```

In [ ]:
```
timss_sci_four_world = timss_sci_four.groupby('Year', as_index=False).mean
timss_sci_four_world['Country Name'] = 'World'
timss_sci_four_world['Country Code'] = 'WRD'
timss_sci_four_world['Indicator Name'] = 'TIMSS: Mean performance on the sc
timss_sci_four_world['Indicator Code'] = 'LO.TIMSS.SCI4'
```

In [ ]:
```
timss_sci_eight_world = timss_sci_eight.groupby('Year', as_index=False).mea
timss_sci_eight_world['Country Name'] = 'World'
timss_sci_eight_world['Country Code'] = 'WRD'
timss_sci_eight_world['Indicator Name'] = 'TIMSS: Mean performance on the s
timss_sci_eight_world['Indicator Code'] = 'LO.TIMSS.SCI8'
```

In [ ]:
```
timss = pd.concat([timss_math_four_th, timss_math_eight_th, timss_sci_four_
timss.head()
```

Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
22971636	Thailand	THA	TIMSS: Mean performance on the mathematics sca...	LO.TIMSS.MAT4	1995-01-01	466.523453
37162516	Thailand	THA	TIMSS: Mean performance on the mathematics sca...	LO.TIMSS.MAT4	2011-01-01	457.975859
22971633	Thailand	THA	TIMSS: Mean performance on the mathematics sca...	LO.TIMSS.MAT8	1995-01-01	516.215545
26519353	Thailand	THA	TIMSS: Mean performance on the mathematics sca...	LO.TIMSS.MAT8	1999-01-01	467.000000
33614793	Thailand	THA	TIMSS: Mean performance on the mathematics sca...	LO.TIMSS.MAT8	2007-01-01	441.000000

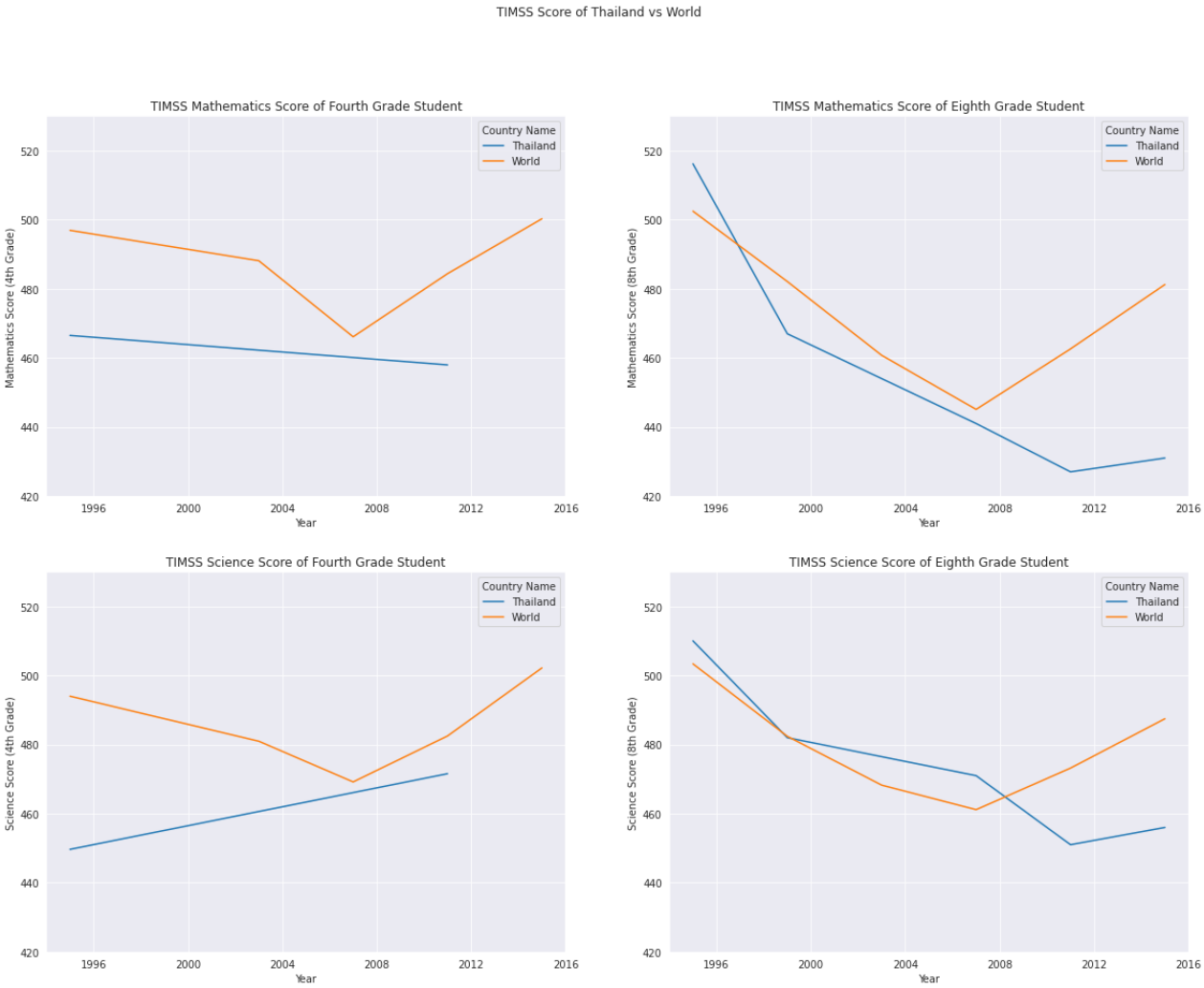
In [ ]:
```
timss_four_math = pd.concat([timss_math_four_th, timss_math_four_world])
timss_eight_math = pd.concat([timss_math_eight_th, timss_math_eight_world]
timss_four_sci = pd.concat([timss_sci_four_th, timss_sci_four_world])
timss_eight_sci = pd.concat([timss_sci_eight_th, timss_sci_eight_world])
```

In [ ]:

```
plt.figure(figsize=(20,15))

# ax.set_title("TIMSS of Thailand vs World")
# ax.set_xlabel('Year')
# ax.set_ylabel('TIMSS')

fig, axs = plt.subplots(2, 2, figsize=(20, 15))
fig.suptitle('TIMSS Score of Thailand vs World')

sns.lineplot(ax=axs[0, 0], data=timss_four_math, x="Year", y="Value", hue=
axs[0, 0].set_title("TIMSS Mathematics Score of Fourth Grade Student")
axs[0, 0].set_xlabel('Year')
axs[0, 0].set_ylabel('Mathematics Score (4th Grade)')
axs[0, 0].set_ylim(420, 530)

sns.lineplot(ax=axs[0, 1], data=timss_eight_math, x="Year", y="Value", hue=
axs[0, 1].set_title("TIMSS Mathematics Score of Eighth Grade Student")
axs[0, 1].set_xlabel('Year')
axs[0, 1].set_ylabel('Mathematics Score (8th Grade)')
axs[0, 1].set_ylim(420, 530)

sns.lineplot(ax=axs[1, 0], data=timss_four_sci, x="Year", y="Value", hue='(
axs[1, 0].set_title("TIMSS Science Score of Fourth Grade Student")
axs[1, 0].set_xlabel('Year')
axs[1, 0].set_ylabel('Science Score (4th Grade)')
axs[1, 0].set_ylim(420, 530)

sns.lineplot(ax=axs[1, 1], data=timss_eight_sci, x="Year", y="Value", hue=
axs[1, 1].set_title("TIMSS Science Score of Eighth Grade Student")
axs[1, 1].set_xlabel('Year')
axs[1, 1].set_ylabel('Science Score (8th Grade)')
axs[1, 1].set_ylim(420, 530)
```

Out[ ]: (420.0, 530.0)

<Figure size 1440x1080 with 0 Axes>



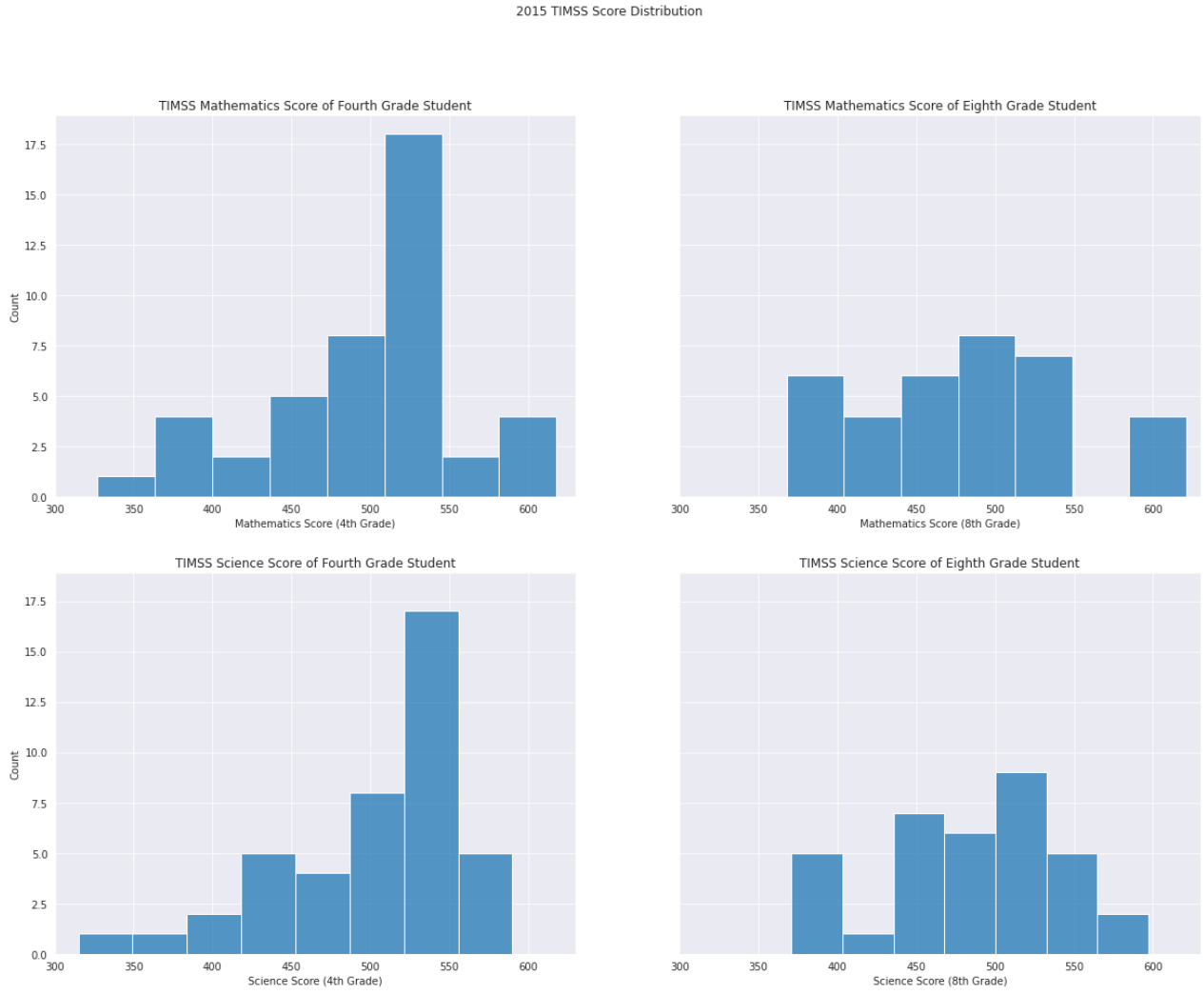
Trends in International Mathematics and Science Study (TIMSS) is an international assessment focused on mathematics and science. Participants in tests are fourth and eighth grade students (or equivalent). In this visuals, it focuses on Thailand performance compare to the world average. From the graphs, we can see that Thailand performance is acceptable on all subjects in almost every years. While eighth students performing around the average, the score performed by fourth grade student is a little bit lower than the world average. So, this confirms that average performance of students in Thailand on mathematics is on avereage. And, Thai student are better at mathematics because study heavier and deeper is a myth. It is a truth that Thai students can achieved many academic internations awards. But look at the whole picture of every students in Thailand, that does not seem to be the case. Another interesting trend is that Thai mathematics and science scores except the science score by fourth grade students has decreasing trend, while the world seems to be an increasing trend after 2007. This could show a sign of a problem that we are moving backwards in term of academic perforamnce at global scale.

In [ ]:
```
timss_math_four_2015 = timss_math_four[timss_math_four['Year'] == '2015-01-
timss_math_eight_2015 = timss_math_eight[timss_math_eight['Year'] == '2015-
timss_sci_four_2015 = timss_sci_four[timss_sci_four['Year'] == '2015-01-01
timss_sci_eight_2015 = timss_sci_eight[timss_sci_eight['Year'] == '2015-01-
```

In [ ]:

```
fig, axs = plt.subplots(2, 2, figsize=(20, 15), sharey=True)
fig.suptitle('2015 TIMSS Score Distribution')

sns.histplot(ax=axs[0, 0], data=timss_math_four_2015, x="Value")
axs[0, 0].set_title("TIMSS Mathematics Score of Fourth Grade Student")
axs[0, 0].set_xlabel('Mathematics Score (4th Grade)')
axs[0, 0].set_ylabel('Count')
axs[0, 0].set_xlim(300, 630)

sns.histplot(ax=axs[0, 1], data=timss_math_eight_2015, x="Value")
axs[0, 1].set_title("TIMSS Mathematics Score of Eighth Grade Student")
axs[0, 1].set_xlabel('Mathematics Score (8th Grade)')
axs[0, 1].set_ylabel('Count')
axs[0, 1].set_xlim(300, 630)

sns.histplot(ax=axs[1, 0], data=timss_sci_four_2015, x="Value")
axs[1, 0].set_title("TIMSS Science Score of Fourth Grade Student")
axs[1, 0].set_xlabel('Science Score (4th Grade)')
axs[1, 0].set_ylabel('Count')
axs[1, 0].set_xlim(300, 630)

sns.histplot(ax=axs[1, 1], data=timss_sci_eight_2015, x="Value")
axs[1, 1].set_title("TIMSS Science Score of Eighth Grade Student")
axs[1, 1].set_xlabel('Science Score (8th Grade)')
axs[1, 1].set_ylabel('Count')
axs[1, 1].set_xlim(300, 630)
```

Out[ ]: (300.0, 630.0)

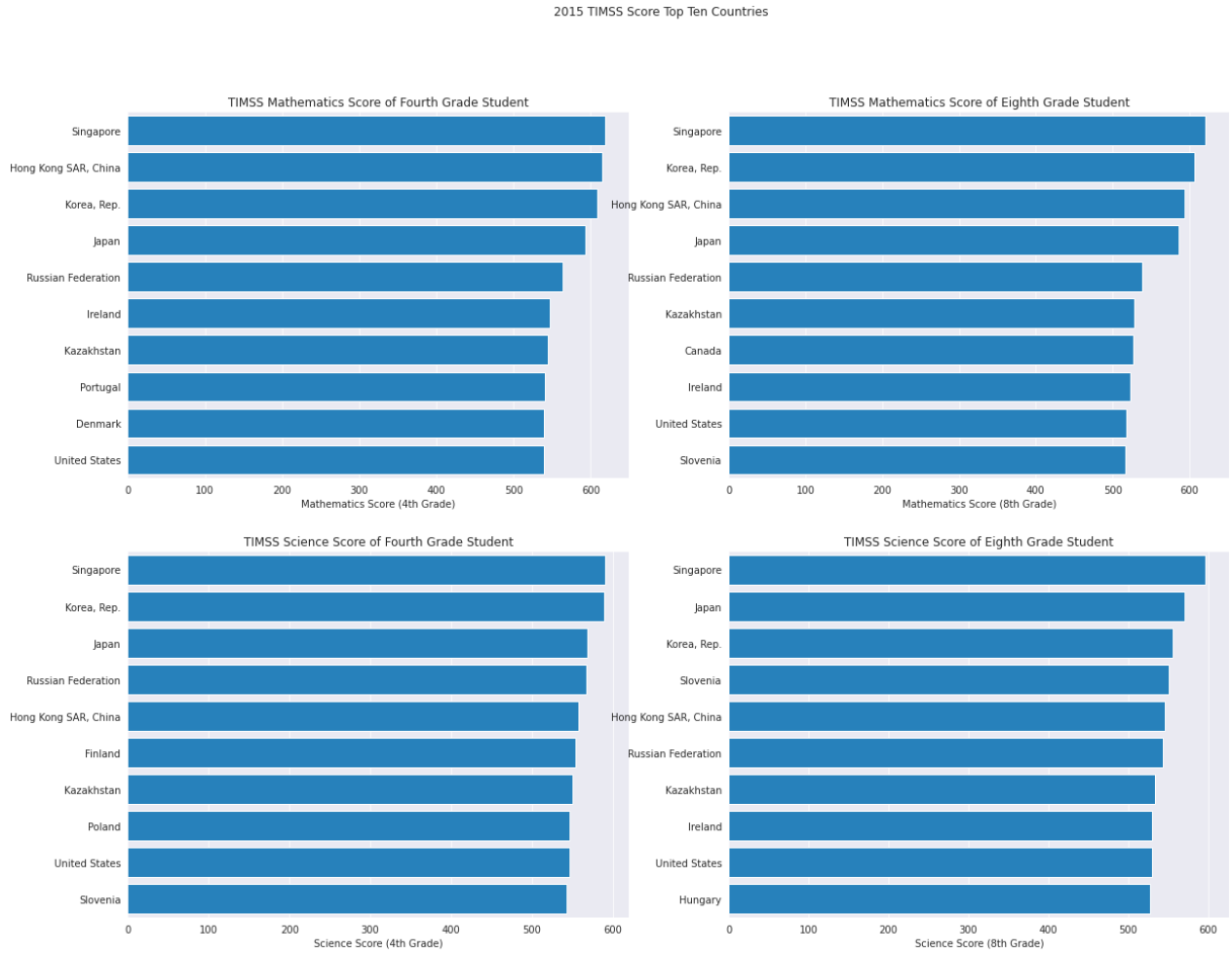


In this chart, it shows the distribution of 2015 TIMSS scores. While the score performing by the eighth students show that mostly flat distributed. The score performed by fourth grade student crowded around 500 - 550.

In [ ]:

```
fig, axs = plt.subplots(2, 2, figsize=(20, 15))
fig.suptitle('2015 TIMSS Score Top Ten Countries')

sns.barplot(ax=axs[0, 0], data=timss_math_four_2015.nlargest(10, 'Value'),
axs[0, 0].set_title("TIMSS Mathematics Score of Fourth Grade Student")
axs[0, 0].set_xlabel('Mathematics Score (4th Grade)')
axs[0, 0].set_ylabel('')

sns.barplot(ax=axs[0, 1], data=timss_math_eight_2015.nlargest(10, 'Value'),
axs[0, 1].set_title("TIMSS Mathematics Score of Eighth Grade Student")
axs[0, 1].set_xlabel('Mathematics Score (8th Grade)')
axs[0, 1].set_ylabel('')

sns.barplot(ax=axs[1, 0], data=timss_sci_four_2015.nlargest(10, 'Value'), x
axs[1, 0].set_title("TIMSS Science Score of Fourth Grade Student")
axs[1, 0].set_xlabel('Science Score (4th Grade)')
axs[1, 0].set_ylabel('')

sns.barplot(ax=axs[1, 1], data=timss_sci_eight_2015.nlargest(10, 'Value'),
axs[1, 1].set_title("TIMSS Science Score of Eighth Grade Student")
axs[1, 1].set_xlabel('Science Score (8th Grade)')
axs[1, 1].set_ylabel('')
```

Out[ ]: Text(0, 0.5, '')



The charts show the top ten countries with highest 2015 score in each category. The highest scores in all categories achieved by Singapore. So, it can said that Singapore students is very strong in mathematics and science skills. Korea Republic, Hong Kong, and Japan seems to be very competitive in term of the score as well. The top three in each categories do not have a large gap in the score, but rather very close cut. Surprisingly, Kazakhastan which has an image of third world country also performing very well and can be included in a top ten in very categories.

Data Wrangling for R/Orange

Data Wrangling for Orange

In [ ]:
```
education[education['Indicator Name'] == 'Gross enrolment ratio, primary, 
```

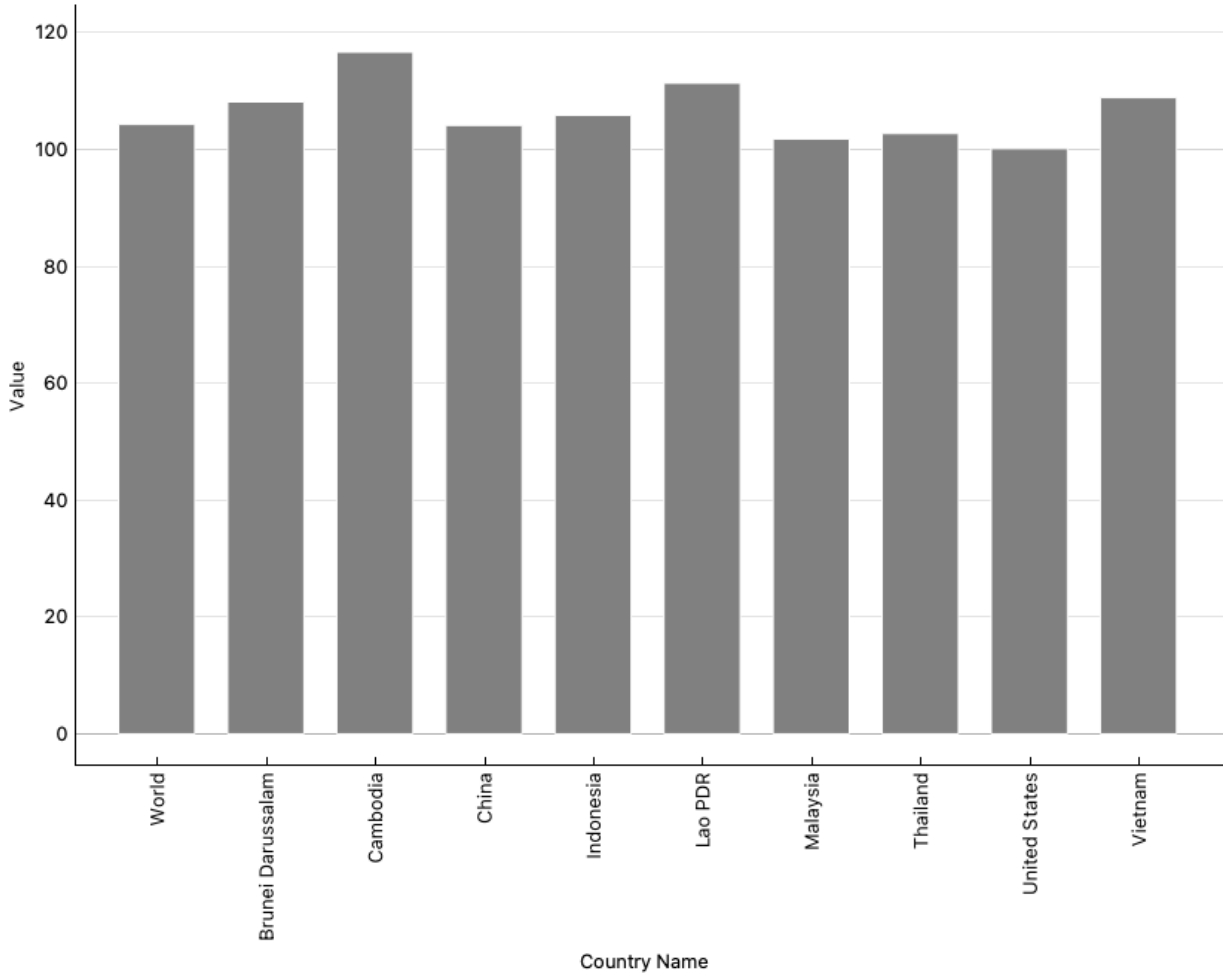
Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
1331	Arab World	ARB	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	1970-01-01	66.621872
4996	East Asia & Pacific	EAS	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	1970-01-01	102.804962
8661	East Asia & Pacific (excluding high income)	EAP	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	1970-01-01	102.708969
12326	Euro area	EMU	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	1970-01-01	107.150627
15991	Europe & Central Asia	ECS	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	1970-01-01	105.036568
...	...	...	...	...	...	...
41397506	Nepal	NPL	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	2016-01-01	135.862137
41437821	Palau	PLW	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	2016-01-01	99.641830
41492796	Sao Tome and Principe	STP	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	2016-01-01	114.956253
41588086	Tajikistan	TJK	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	2016-01-01	100.468292
41654056	Uzbekistan	UZB	Gross enrolment ratio, primary, both sexes (%)	SE.PRM.ENRR	2016-01-01	104.397751

8083 rows × 6 columns

In [ ]:

```
education[education['Indicator Name'] == 'Gross enrolment ratio, primary, b
```



The bar plot show the percentage number of gross enrollment ratio for Thailand compare to the world, USA, China and some ASEAN countries. Gross Enrollment Ratio (GER) is an index show the number of people attend the primary schooling. The GER index can be over 100% since 100% is the population at the actual age of attending the primary school. But there are some other people who are overage or underage that attend that schooling as well which is why it can be over 100%. Thailand performs quite well compare to the world average. But we don't know for sure if it really mean anything since we don't know how much each subgroup of actual popluation, over-age, under-age contributed to the total number of percentage. We have to check further.

Data Wrangling for R

In [ ]:
```
education[education['Indicator Name'] == 'Barro-Lee: Percentage of populat
```

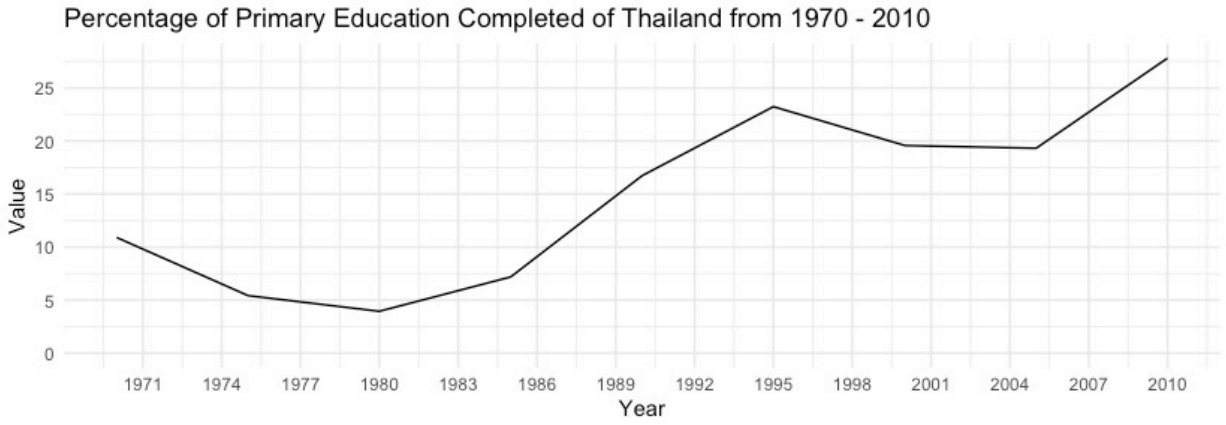
Out[ ]:

	Country Name	Country Code	Indicator Name	Indicator Code	Year	Value
92000	Afghanistan	AFG	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	1970-01-01	0.41
95665	Albania	ALB	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	1970-01-01	23.49
99330	Algeria	DZA	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	1970-01-01	5.23
117655	Argentina	ARG	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	1970-01-01	30.77
121320	Armenia	ARM	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	1970-01-01	19.17
...	...	...	...	...	...	...
36338850	Venezuela, RB	VEN	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	2010-01-01	26.67
36342515	Vietnam	VNM	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	2010-01-01	14.29
36353510	Yemen, Rep.	YEM	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	2010-01-01	10.56
36357175	Zambia	ZMB	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	2010-01-01	27.45
36360840	Zimbabwe	ZWE	Barro-Lee: Percentage of population age 15+ wi...	BAR.PRM.CMPT.15UP.ZS	2010-01-01	26.68

1296 rows × 6 columns

In [ ]:

```
education[education['Indicator Name'] == 'Barro-Lee: Percentage of populati
```



This time series plot comes to surprise that only around 27-28% can complete their primary schooling in Thailand in 2010. Primary schooling contains many fundamental knowledge for living in the modern society. Without these skills and knowledge, it will be the disadvantage for a person and limit their future.

Final Note

Even many of the analysis and visualizations show that there are a lot of myths in Thai education system, for example, the mathematics performance, it also remind us how long we need to go forward to improve our education system and make our young generations ready for anything in the future. We saw that COVID-19 affect many aspects of our life and how it can destory and create many new opportunities. We have to accept that the current education system is not capable enough to prepare our children for the unforseen future. We have to change. Our next generation must be flexible and adaptive than us. STEM is the future and our children's skills haven't reach the standard that can compete with other countries. We have to start today to change and make our society ready for the next generation.